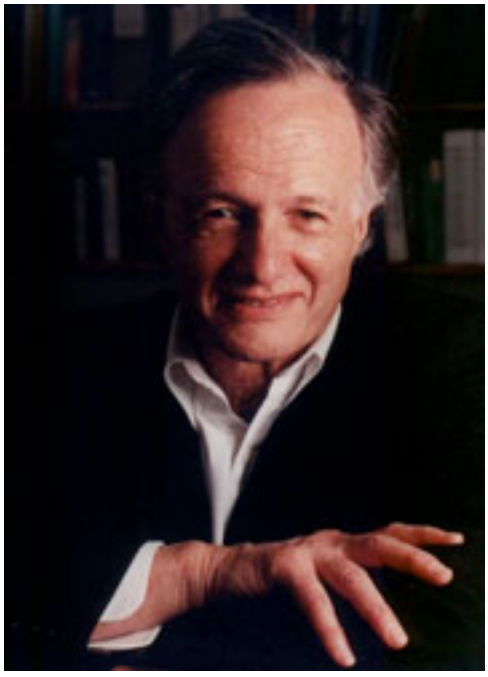
Prof. John Charles Polanyi
Professor at the University of Toronto. Nobel laureate in Chemistry, 1986



Most important awards, prizes and academies

Awards: Marlow Medal of the Faraday Society, UK (1962); Steacie Prize for the Natural Sciences (1965); Henry Marshall Tory Medal of the Royal Society of Canada (1977); Wolf Prize in Chemistry, shared with G. Pimentel (1982); Nobel laureate in Chemistry (1986). *Academies*: Royal Society of Canada; Royal Society of London; American Academy of Arts and Sciences; National Academy of Sciences, USA; Companion of the Order of Canada; Pontifical Academy of Sciences; Russian Academy of Sciences.

Summary of scientific research

The past decades have seen the birth of a field of chemical physics termed 'reaction dynamics', the study of the atomic and molecular motions underlying chemical reaction. Starting in 1956, J.C. Polanyi's laboratory at the University of Toronto at tempted to detect and measure the extent of vibration and rotation in reaction products from gaseous reaction by recording their emission in the infrared. Ultimately these experiments yielded quantitative data concerning the motions in molecules at the instant of their formation, and also the effect on these product motions of systematic alterations in the corresponding motions in the reagents. From these data it was

possible, by means of Monte Carlo trajectory computations performed in this and other laboratories, to obtain some insight into the patterns of motion in the course of transition from reagents into products. More recently Polanyi's laboratory has been involved in an attempt to establish, through theory and experiment, a means of probing the subpicosecond 'transition state' directly, either by recording feeble emission or by laser absorption; this area of research (still in its infancy) constitutes 'transition state spectroscopy'. In a second recent departure this laboratory has turned its attention to the dynamics of simple reactions occurring at sur faces. Following adsorption of submonolayers on the surface, reaction is initiated by ultraviolet light. The present indication is that this procedure can result in reaction between coadsorbed species, both held at the surface, with preferred locations and orientations. Most recently his laboratory has been involved in studying photoreaction one molecule at a time, beneath the tip of a Scanning Tunneling Microscope. The hope, therefore, is to exploit this 'surface aligned photochemistry' as a means of improving our understanding, and therefore our control, over microscopic reaction pathways - the molecular choreography of the reactive process.

Main publications

Cashion, J.K. and Polanyi, J.C., Infrared Chemiluminescence from the Gaseous Reaction Atomic H Plus Cla, *J. Chem. Phys.*, 29, p. 455 (1958); Polanyi, J.C., Energy Distribution Among Reagents and Products of Atomic Reactions, *J. Chem. Phys.*, 31, p. 1338 (1959); Polanyi, J.C., Proposal for an Infrared Maser Dependent on Vibrational Excitation, *J. Chem. Phys.*, 34, p. 347 (1961); Polanyi, J.C., The Iraser and Vaser. A Proposal for an Infrared and Visible Analogue of the Maser, *Proc. Roy. Soc.* (Canada), 54(C), p. 25 (1960); Polanyi, J.C., Vibrational-Rotational Population Inversion, *J. Appl. Optics. Chemical Laser Supplement*, pp. 109-127 (1965); Kuntz, P.J., Nemeth, E.M., Polanyi, J.C., *et al.*, Energy Distribution Among Products of Exothermic Reactions. II. Repulsive, Mixed and Attractive Energy Release, *J. Chem. Phys.*, 44, p. 1168 (1966); Polanyi, J.C. and Wong, W.H., Location of Energy Barriers. I. Effect on the Dynamics of Reaction A+BC, *J. Chem. Phys.*, 51, p. 1439 (1969); Mok, M.H. and Polanyi, J.C., Location of Energy Barriers. II. Correlation with Barrier Height, *J. Chem. Phys.*, 51, p. 1451 (1969); Ding, A.M.G., Kirsch, L.J., Perry, D.S., Polanyi, J.C. and Schreiber, J.L., The Effect of Changing Reagent Energy on Reaction Probability, and Product Energy-Distribution, *Faraday Disc. Chem. Soc.*, 55, p. 252 (1973); Polanyi, J.C. and Schreiber, J.L., The Reaction F+H2->HF+H: A Case Study in Reaction Dynamics, *Faraday Disc. Chem. Soc.*, 62, p. 267 (1977); Foth, H.-J., Polanyi, J.C. and Telle, H.H., Emission from Molecules and Reaction Intermediates in the Process of Falling Apart, *J. Phys. Chem.*, 86, p. 5027 (1982); Arrowsmith, P., Bly, S.H.P., Charters, P.E. and Polanyi, J.C., Spectroscopy of the Transition State. II. F+Na2->FNaNa+' ->NaF+Na', *J. Chem. Phys.*, 79, p. 283 (1983); Bourdon, E.B.D., Cowin, J.P., Harrison, I., Polanyi, J.C., *et al.*, UV Photodissociation and Photodesorption of Adsorbed Molecules. I: CH2Br on LiF(001), *J. Phys. Chem.*, 88, p. 6100 (1984); Bourdon, E.B.D., Das, P., Harrison, I., Polanyi, J.C., *et al.*, Photodissociation, Photoreaction and Photodesorption of Adsorbed Species. II. CH2Br and H2S on LiF(001), *Faraday Diac. Chem. Soc.*, 82 (1986); Lu, P.H., Polanyi, J.C. and Rogers, D.,

Photoinduced Localized Atomic Reaction (LAR) of 1,2- and 1,4-dichlorobenzene with Si(111)7x7, *J. Chem. Phys.*, 112, p. 11005 (2000); Jiang, G., Polanyi, J.C., Rogers, D., Electron and Photon Irradiation of Benzene and Chlorobenzene on Si(111)7x7, *Surface Science*, 544, p. 147 (2003); I.D. Petsalakis, J.C. Polanyi and G. Theodorakopoulos, Theoretical Study of the Induced Attachment of Benzene to Si(111)-7x7, *Surface Science* 544, 162 (2003); S. Dobrin, H. He, F.Y. Naumkin, J.C. Polanyi, and S.A. Raspopov, Photoinduced Charge-Transfer Reaction at Surfaces. Part II: HBr...Nan/LiF(001) + hf(610 nm)->Br-Na+n/LiF(001) + H(g), *J. Chem. Phys*. 119, 9795 (2003); F.Y. Naumkin, J.C. Polanyi, et al., Electron-Induced Attachment of Chlorinated Benzenes to Si(100)-2x1, *Surface Science* 547, 324 (2003); C.F. Matta and J.C. Polanyi, Chemistry on a Peg-Board: The Effect of Adatom-to-Adatom Separation on the Reactivity of Dihalobenzenes at Si(111)-7x7 Surfaces, *Phil. Trans. Royal Soc. London* A, 362, 1185 (2004); S. Dobrin, K. Rajamma Harikumar and J.C. Polanyi, An STM Study of the Localized Atomic Reaction of 1,2 and 1,4-diBrPh at Si(111)-7x7, *Surface Science* 561, 11 (2004); K. Rajamma Harikumar, I.D. Petsalakis, J.C. Polanyi and G. Theodorakopoulos, Parent- and Daughter-Mediated Halogenation Reactions Modeled For 1,2- and 1,4-Dibromobenzene at Si(111)-7x7, *Surface Science* 572, 162 (2004); S. Dobrin, X. Lu, F.Y. Naumkin, J.C. Polanyi and J. (S.Y.) Yang, Imprinting Br-Atoms at Si(111) from a SAM of CH3Br(ad), with Pattern Retention, *Surf. Sci. Letters* 573, L363 (2004); S. Dobrin, J.B. Giorgi, F.Y. Naumkin and J.C. Polanyi, Photoinduced Charge Transfer Reaction at Surfaces. III. (HF)2...Nan/LiF(001) + hf(640 nm) -> HFF-Nan+/LiF(001) + H(g), *J. Chem. Phys.* 122, 14705 (2005); S. Dobrin, K. Rajamma Harikumar, C.F. Matta and J.C. Polanyi, An STM Study of the Localized Atomic Reaction of 1,2 and 1,4-Dibromoxylene at Si(111)-7x7, *Surf. Sci.*, 580, 39 (2005); H.E. Ruda, J.C. Polanyi, *et al.*, Developing 1D Nanostructure Arrays for Future Nanophotonics, *Nanoscale Research Letters*, 1, 99 (2006); S. Dobrin, K. Rajamma Harikumar and J.C. Polanyi, STM Study of the Conformation and Reaction of Long-Chain Halo Alkanes at Si(111)-7x7, *J. Phys. Chem. B.* 110, 8010 (2006); X. Lu, J.C. Polanyi and J. (S.Y.) Yang, A Reversible Molecular Switch Based on Pattern-Change in Chlorobenzene and Toluene on a Si(111)-(7x7) Surface, *Nano Lett.* 6, 809 (2006); S. Dobrin, K.R. Harikumar, R.V. Jones, I.R. McNab, J.C. Polanyi, *et al.*, Molecular Dynamics of Haloalkane Corral-Formation and Surface Halogenation at Si(111)-7x7, *J. Chem. Phys*. 125, 133407 (2006); K.R. Harikumar, J.C. Polanyi, *et al.*, Electronic Switching of Single Silicon Atoms by Molecular Field Effects, *J. Am. Chem. Soc.*, 128, 16791 (2006); S. Dobrin, K.R. Harikumar, T.B. Lim, L. Leung, I.R. McNab, J.C. Polanyi, *et al.*, Maskless nanopatterning and formation of nano-corrals and switches, for haloalkanes at Si(111)-7x7, *Nanotechnology*, 18, 044012 (2007).