Nobel Prizes 2010

Chemistry

The Nobel laureates in Chemistry for 2010 have provided Chemists with highly useful methods: Richard F. Heck, Ei-ichi Negishi, and Akira Suzuki have been honored for their work on palladium-catalyzed cross-coupling.[1a] Their names are already well-known by any chemist who wants to couple together carbon atoms, whether it be for the total synthesis of natural products or the synthesis of new materials. "Very few reactions have increased the efficiency of organic syntheses in such a fashion", writes J.-E. Bäckvall in the background information from the Nobel Committee for Chemistry. Work on catalysis has thus been the subject of a Prize for the fourth time in ten years (following 2001, 2005, and 2007). In 2002, Negishi was the editor of a two-volume handbook on palladium-catalyzed reactions in organic chemistry in which Suzuki contributed a chapter.[1b]

Richard F. Heck (Photo: University of Delaware)

Ei-ichi Negishi (Photo: Purdue University)

Akira Suzuki (Photo: Hokkaido University)

Heck (*1931) received his doctorate in 1954 under S. Winstein at the University of California, Los Angeles. He then worked as a postdoctoral fellow at the ETH Zurich and the company Hercules in Wilmington (USA). In the late 1960s and early 1970s, he worked on the addition of alkyl- and phenylpalladium halides generated in situ to olefins at room temperature and on the mechanism of these reactions.[1c] From 1971 to 1989 he taught and carried out research at the University of Delaware, Newark (USA).

Negishi (*1935) completed his doctorate in 1963 at the University of Pennsylvania in Philadelphia under A. R. Day and then worked at Purdue University in West Lafayette (USA), initially with H. C. Brown. In the late 1970s, he presented mild reagents for cross-coupling reactions: initially organozirconium and organoaluminum compounds, then the corresponding zinc compounds with which carbon atoms can be more easily coupled with, for example, Grignard reagents. Negishi was still actively carrying out research in this decade; for example, he reported in *Angewandte Chemie* on the stepwise alkylation of 1,1-dichloro-1-alkenes,[1d] and in the *European Journal of Organic Chemistry* on a simple method for the selective synthesis of isoprenoids by utilizing *E*/*Z* isomerization.[1e]

Suzuki (*1930) received his doctorate in 1959 at Hokkaido University, Sapporo (Japan) and was, after a research stay with H. C. Brown (Purdue) in the late 1960s, a professor there from 1965 until 1994. Towards the end of the 1970s he was able to show that organoboron compounds can be coupled with vinyl and aryl halides under basic conditions and palladium catalysis.[1f] All three reaction types carry the name of their discoverer and are used on an industrial scale.

Physics

The Nobel Prize for Physics was awarded to André Geim and Konstantin "Kostya" S. Novoselov (University of Manchester) for their work on graphene. The fact that graphene consists of one single layer of graphite has been known since the 1960s;[2a] however the unique electronic, optical, mechanical, and catalytic properties of this material has only become clear this decade thanks to the work of the prize winners,[2b–d] and has made graphene popular with chemists. At 36 years of age, Novoselov is much older that the youngest Nobel laureate in physics, W. L. Bragg (who was 25 years old when he was awarded in 1915), but he is the youngest since R. Mössbauer (1961, at the age of 32).

Medicine/Physiology

The Nobel Prize in Medicine was awarded to Robert G. Edwards, who together with Patrick Steptoe (who died in 1988), developed human in vitro fertilization (IVF) at the Bourne Hall Clinic in Cambridge (UK). In 1978, the first child was born as a result of IVF; to date about four million children have been born following IVF.

[1] a) *Metal-Catalyzed Cross-Coupling Reactions* (Eds: F. Diederich, A. de Meijere), Wiley-VCH, Weinheim, **2004**; b) *Handbook of Organopalladium Chemistry for Organic Synthesis* (Eds: E. Negishi, A. de Meijere), Wiley, New York, **2002**; review on classic Heck reactions and variations: c) A. de Meijere, F. E. Meyer, *Angew. Chem.* **1994**, *106*, 2473; *Angew. Chem. Int. Ed. Engl.* **1994**, *33*, 2379; d) Z. Tan, E. Negishi, *Angew. Chem.* **2006**, *118*, 776; *Angew. Chem. Int. Ed.* **2006**, *45*, 762; e) G. Wang, E. Negishi, *Eur. J. Org. Chem.* **2009**, 1679; review of the mechanism of the Suzuki reaction and applications to natural product synthesis: f) S. R. Chemler, D. Trauner, S. J. Danishefsky, *Angew. Chem.* **2001**, *113*, 4676; *Angew. Chem. Int. Ed.* **2001**, *40*, 4544.

[2] a) H.-P. Boehm, *Angew. Chem.* **2010**, *122*, DOI: 10.1002/ange.201004096; *Angew. Chem. Int. Ed.* **2010**, *49*, DOI: 10.1002/anie.201004096; b) F. Freitag, A. J. M. Giesbers, U. Zeitler, S. V. Morozov, P. Blake, A. K. Geim, K. S. Novoselov, *Small* **2010**, *6*, 1469; c) C. N. R. Rao, A. K. Sood, K. S. Subrahmanyam, A. Govindaraj, *Angew. Chem.* **2009**, 121, 7890; *Angew. Chem. Int. Ed.* **2009**, *48*, 7752; d) D. R. Dreyer, R. S. Ruoff, C. W. Bielawski, *Angew. Chem.* **2010**, *122*, DOI: 10.1002/ange.201003024; *Angew. Chem. Int. Ed.* **2010**, *49*, DOI: 10.1002/anie.201003024.

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