T. Aida

*Takuzo Aida has recently published his **25th article** since 2000 in Angewandte Chemie:*
"Self-Repair of a One-Dimensional Molecular Assembly in Mesoporous Silica by a Nanoscopic Template Effect": H. O. Lintang, K. Kinbara, K. Tanaka, T. Yamashita, T. Aida, *Angew. Chem.* **2010**, *122*, 4337–4341; *Angew. Chem. Int. Ed.* **2010**, *49*, 4241–4245.

Takuzo Aida

Date of birth:	May 3, 1956
Position:	Professor, Department of Chemistry and Biotechnology, School of Engineering, The University of Tokyo (Japan)
Education:	1975–1979 BS in chemistry Yokohama National University, Yokohama (Japan) 1979–1984 MS and PhD with Prof. Shohei Inoue, "Controlled Macromolecular Synthesis with Metalloporphyrins", The University of Tokyo, Tokyo (Japan)
Awards:	**1988** The Chemical Society of Japan Award for Young Chemists; **1993** Award of the Society of Polymer Science, Japan; **1999** Wiley Polymer Chemistry Award; **1999** IBM Science Award; **2000** Nagoya Medal Seminar Silver Medal; **2001** Tokyo Techno Forum Gold Medal; **2004** Arthur K. Doolittle Award; **2005** Inoue Prize for Science; **2008** Molecular Chirality Award; **2008** Award for the Contribution to Coordination Chemistry; **2009** American Chemical Society Award in Polymer Chemistry; **2009** Chemical Society of Japan Award
Current research interests:	Design of advanced functional materials based on supramolecular chemistry for energy, health, and environmental issues
Hobbies:	Computer graphics

If I were not a scientist, I would be … an architect or a designer.

My favorite subject at school was … art because art provides essentially unlimited possibilities based on one's imagination.

When I was eighteen I wanted to be … a dentist because their life seemed to be extremely easy (chemistry was not popular at all at that time because of a bad perception that it causes deterioration of the environment).

When I wake up I … take a hot bath.

The biggest problem that scientists face is … the accelerated consumption of energy and fossil resources whilst the environmental disruption that this causes has not yet been seriously considered.

The three qualities that make a good scientist are … creativity, flexibility, and passion.

My science "heroes" are … Prof. Yoshio Okamoto (Nagoya University, Japan) and Roeland J. M. Nolte (Radboud University, Nijmegen, The Netherlands) because they discovered helical structures in synthetic macromolecules. The helix is the most beautiful architecture in the world and exists in a wide range of dimensions from the molecular scale to a macroscopic length scale.

Chemistry is fun because … one can synthesize totally new compounds and explore their potential.

I chose chemistry as a career because … of its huge potential for anyone to become a super idealist.

My first experiment was … to synthesize poly(propylene oxide) with a narrow molecular-weight distribution by using an aluminum porphyrin initiator for controlled ring-opening polymerization.

My favorite food is … a very spicy Korean dish or super-hot Chinese food in addition to Sushi.

My favorite musician composer is … Johann Sebastian Bach or Frédéric François Chopin.

If I could be described as an animal it would be … a cat even though I prefer dogs much more. A big difference between cats and dogs is that cats eat their favorite food first and leave the rest when they are satisfied, whereas dogs eat their favorite food at the end of their dinner. We Japanese discuss this as "in which order may one eat sushi?".

How is chemistry research different now than it was at the beginning of your career?

Chemistry research now is more complicated than it was in 1980. At the same time, it is becoming more challenging than before. We scientists have larger (social and political) pressures to create something new that can be practically valuable. This might be inevitable because the amount of scientific funding has increased a lot for the last two decades in particular. A positive aspect of such pressures is that we can sometimes recognize things that are missing or should be developed for solving problems of practicality. However, a negative aspect is that people tend to combine existing science and technologies to facilitate their research. If this tendency becomes more significant, we might use up all of our resources.

Has your approach to chemistry research changed since the start of your career?

I started my research carrier in synthetic polymer chemistry, investigating the living anionic polymerization of heterocyclic and vinyl monomers by using aluminum porphyrins as initiators for precision polymerization. At that time, I was not at all interested in assembled structures, functions, and properties of polymers. However, when the department offered me an independent position sixteen years ago, I decided to move away slightly from classical synthetic polymer chemistry and I started a new project on dendrimer porphyrins together with polymerization in mesoporous silica. This research required me to have a spirit of exploration with a physics flavor. Initially, it was rather hard for me, but I gradually started to recognize that there were many more enjoyable fields of chemistry. When I had a chance to run one of the biggest scientific projects in our country (ERATO), I decided to go further along this line and I began supramolecular chemistry with an intense flavor of polymer chemistry.

Has your approach to publishing your results changed since the start of your career?

Yes, it has changed a lot. As described above, I had been heavily involved in synthetic polymer chemistry for the first fifteen years of my carrier. At the stage of publishing the results, we mostly considered specialized journals for which no particular messages in the introduction were necessary. Why did we consider specialized journals? This was because studies on polymers at that time were considered to be just like applied research. Furthermore, synthetic polymers were taken as poorly defined mixtures of molecules with different stereochemical features and molecular weights. However, thanks to huge progresses in analytical methods and a stronger demand for high-performance materials with nanoscopic structural precision, polymers became better understood than before, so that general chemistry journals and even general science magazines started to recognize the significance of polymers and organic assemblies. As the result of this, scientists working in these fields became more exposed to publishing in such journals.

What do you think the future holds for your field of research?

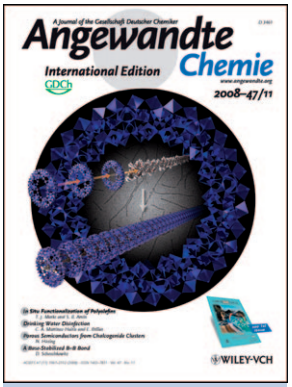
Nobody can predict the future—that is why life is interesting. Nevertheless, most of my current work is related to issues of energy, health, and the environment. The importance of these issues has been well recognized publicly. Because these are long-term issues, even after my retirement these must warrant further extensive studies.

Have you changed the main focus of your research throughout your career and if so why?

Yes, I did change my focus. One of the reasons was described above, but honestly, there was also a more personal reason. In Japan, depending on the institution, a laboratory can be composed of a full professor, an associate professor or a lecturer, and one or two research associates (assistant professors now). This system is great for all of them to perform their research very efficiently. However, a negative aspect is that the capabilities of individual members, except the full professor, might be invisible. When I obtained an independent position, I initially wondered if I should change my focus completely in order to confirm and show my own capability. However, I finally decided to stay in the same research field with a slightly different target, that is, to develop universal initiators for controlling radical polymerization. This target was unexplored at that time and because I had an enough experience of porphyrins, I chose, based on vitamin B_{12} chemistry, organocobalt porphyrins as potential initiators for achieving living radical polymerization. However, one year later I found in the *Journal of the American Chemical Society* a new paper by Prof. Wayland et al. on the same subject (B. B. Wayland et al., *J. Am. Chem. Soc.* **1994**, *116*, 7943–7944). This beautiful work was enough for me to decide to change my research focus entirely.

What has been your biggest influence/motivation?

Curiosity is one of my big motivations. Many people occasionally ask me why I have been doing several different types of work. I always answer this question in such a way that I simply try to get rid of a sort of sectionalism. Researchers, except those working for target-oriented industries, should be free, but in some cases they need to make some intentional changes in their life. I now focus more attention on issues related to energy, health,



T. Aida has been featured on the cover of Angewandte Chemie
"Directed 1D Assembly of a Ring-Shaped Inorganic Nanocluster Templated by an Organic Rigid-Rod Molecule: An Inorganic/Organic Polypseudorotaxane": M. A. Alam, Y.-S. Kim, S. Ogawa, A. Tsuda, N. Ishii, T. Aida, *Angew. Chem.* **2008**, *120*, 2100–2103; *Angew. Chem. Int. Ed.* **2008**, *47*, 2070–2073.

and the environment. I am afraid that this might be a sign that I am getting old.

What advice would you give to up-and-coming scientists?

I do not think that up-and-coming scientists need advice. To my students, I always advise that they have to make a strong scientific platform that is supported by solid research experience. Such a platform always welcomes them whenever they struggle, gives them an opportunity to think deeply, and activates them again to go back for a challenge. However, a reliable platform can be created only when one devotes oneself, in a certain period, to a particular research subject deeply. I always strengthen this point.

What is the secret to publishing so many high-quality papers?

I am afraid that I myself have not done so. However, I have been trying to ensure that all of our publications have their own individual characteristics. I am not trying to publish as many papers as possible, and in this sense I am really a slow writer. Although some of my students might struggle with my publication principle, most of them fortunately understand the significance of the experience to complete highly original work. Histories of publications most likely reflect the personalities of individual researchers. In my laboratory, students have to prepare a draft manuscript. Then I work together with the students to polish-up the manuscript on a 52-inch wide-screen LC TV connected to a Mac. This "live collaboration" allows students to recognize how difficult and enjoyable the writing process is.

My 5 top papers:

1. "Extrusion Polymerization: Catalyzed Synthesis of Crystalline Linear Polyethylene Nanofibers Within a Mesoporous Silica": K. Kageyama, J.-i. Tamazawa, T. Aida, *Science* **1999**, *285*, 2113 – 2115.
   This paper reports the first example of achieving controlled polymerization and processing simultaneously with aligned inorganic nanopores. Extruded nanofibers of ultrahigh-molecular-weight polyethylene, thus obtained with an immobilized metallocene, are substantially linear with negligible branches. Furthermore, they are highly crystalline with an extended-chain conformation.
2. "Molecular Ordering of Organic Molten Salts Triggered by Single-Walled Carbon Nanotubes": T. Fukushima, A. Kosaka, Y. Ishimura, T. Yamamoto, T. Takigawa, N. Ishii, T. Aida, *Science* **2003**, *300*, 2072 – 2074.
   This paper reports the first gelatinous materials composed of ionic liquids and single-walled carbon nanotubes. Because of their easy preparation (just grinding) along with their very unique properties, many research groups, including us, developed high-performance devices and materials. In particular, stretchable electronic devices and actuators have attracted particular attention and demonstrate the great potential of such soft materials, referred to as "bucky gels", for many practical applications.
3. "Self-Assembled Hexa-*peri*-hexabenzocoronene Graphitic Nanotube": J. P. Hill, W. Jin, A. Kosaka, T. Fukushima, H. Ichihara, T. Shimomura, K. Ito, T. Hashizume, N. Ishii, T. Aida, *Science* **2004**, *304*, 1481 – 1483.
   This work reports the first fully designable conductive nanotube with a graphite-like wall structure. Not only their great potential for tailoring electronic devices with a nanoscopic structural precision, but also the design strategy that made such an extraordinary self-assembling event possible, have inspired chemists to fabricate several new electroactive 1D nanostructures. The helical chirality of this nanotube also gave us many interesting possibilities.
4. "Mechanical Twisting of a Guest by a Photoresponsive Host": T. Muraoka, K. Kinbara, T. Aida, *Nature* **2006**, *440*, 512 – 515.
   Because there are several interlocked molecular architectures that allow simple reciprocal or rotary motion, in this work we wanted to design an interlocked system that enables very complicated motion, including transmission and translation events of different motions among individual components. For visualizing the motion involved, we needed to develop, in advance, the synthetic chemistry of chiral tetrasubstituted ferrocene derivatives. The first author, as a PhD student, took nearly three years to accomplish this extremely difficult task.
5. "High-Water-Content Mouldable Hydrogels by Mixing Clay and a Dendritic Molecular Binder": Q. Wang, J. L. Mynar, M. Yoshida, E. Lee, M. Lee, K. Okuro, K. Kinbara, T. Aida, *Nature* **2010**, *463*, 339 – 343.
   This paper shows a new direction of hydrogels by demonstrating the successful fabrication of a mouldable, self-standing hydrogel only by using a minute amount of organic components (< 0.2 wt %). Because the hydrogel is composed mostly of water, this may be called an "aqua material". We hope that advanced versions of aqua materials with ultralow contents of organic components may be used in the future as an alternative to petroleum-based plastics.

DOI: 10.1002/anie.201004669

