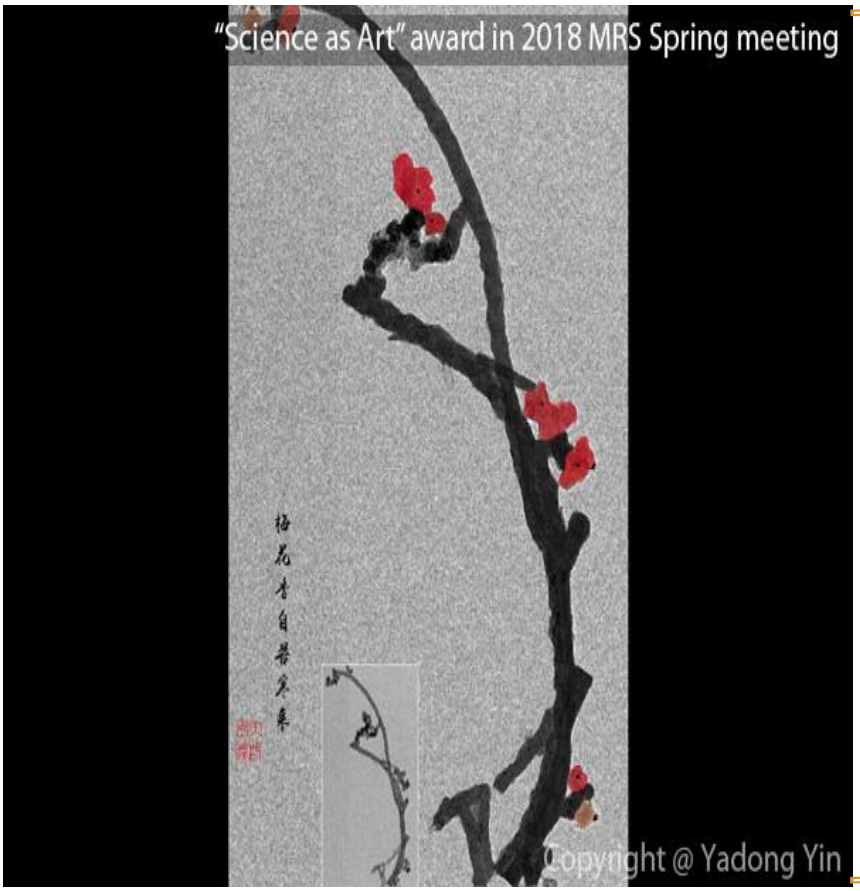
Trained 60 Professors!

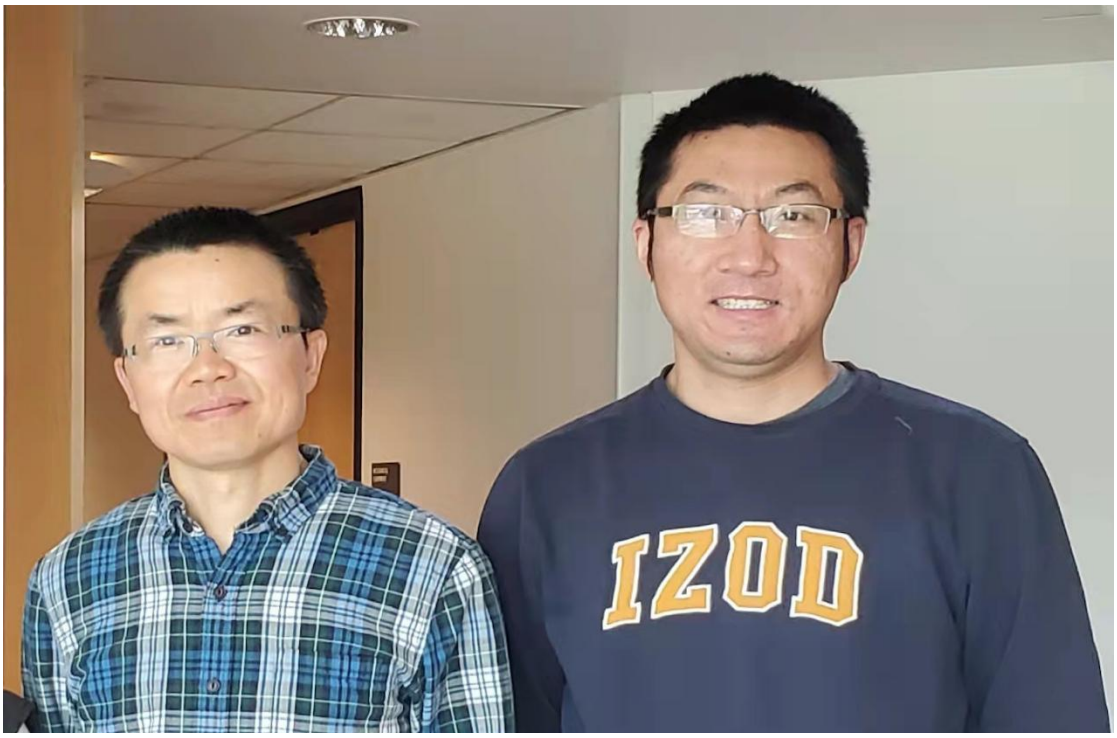
Been Working for 17 Years to Publish Science



When you open the homepage of Yin Yadong Laboratory's website, what comes to your eyes is not the latest research results, but a beautiful "painting": there are plum blossoms standing proudly, watermelon vines full of fruits, golf balls, coral reefs, and lofty mountains.

Understanding only to find out that these colorful paintings are not painted by brushes, but nanoparticles under the microscope, which have been assembled to show a variety of appearance. "Scientific research is sometimes monotonous, and I hope we can find some 'fun' in it." Therefore, Yin Yadong always encourages his classmates to take pictures of interesting images from experiments, especially when they don't go well.

Yadong Yin is a professor at the University of California, Riverside, U.S.A. Over the past 17 years, 60 of the master's and doctoral students, postdoctoral fellows and visiting scholars trained in his lab have become full and associate professors and researchers in universities and research institutes both at home and abroad.



Yin Yadong (left) and Li Zhiwei

Recently, his team published a paper in Science, demonstrating for the first time that magnetic field distributions are chiral, and developed a new method for creating chiral structures by assembling nanoparticles in a magnetic field. This can be widely used in various types of nanomaterials. "If there is any serendipity in this research, it is this: I met an excellent PhD student - Zhiwei Li." Yadong Yin told Science China Daily. Before this Science study was published, Yadong Yin had been working in the field of magnetic assembly of nanomaterials for 17 years.

To summarize, he and his team have been doing two things: "making soldiers" and "deploying soldiers". The former is the continuous preparation of new nanomaterial particles, such as various metal and oxide nanoparticles. The latter is assembly, where nanoparticles are placed in the right place according to the material properties and actual needs, so that they can form new structures and realize special functions.

This is where the difficulty lies. Imagine how difficult it is for two boats floating in the Pacific Ocean to find each other. What if there are n boats, how can we get them to line up on command?

Magnetic assembly is the way to go. "Take a magnet and you can pick up all the nails that are scattered everywhere. If different nanoparticles are attached to an iron oxide material, the nanoparticles can be lined up by a magnetic field. By changing the size of the magnetic field, these nanoparticles take on different structures and properties." Yin Yadong said.

For example, magnetically assembled nanoparticles will form long chains with periodicity that diffract light to form photonic crystal materials. If embedded in a banknote, it will change color when it meets a magnet, which can be applied in anti-counterfeiting signs and anti-counterfeiting coatings.

Another example is chemical substance detection, where a drop of detection solution is placed on the corresponding photonic crystal, and based on its color change, it can be determined whether a certain substance is present or not.

Referring to the Science paper recently published by the group, its conclusion is not complicated at all, and can even be summarized in six words: magnetic fields are chiral. In other words, the distribution of magnetic fields along the central axis, like our right and left hands, mirror each other but do not completely coincide.

Based on this property, researchers are then able to make any material rapidly form chiral structures on the molecular to nanometer scale through magnetic assembly.

If this is such a concise and clear conclusion, why did no one expect it to be the first author, Zhiwei Li, who got the first bite of the crab?

It all started a few years ago, when Zhiwei Li graduated from Soochow University with a master's degree and moved to the University of California, Riverside in 2014 to pursue his doctoral studies with Yadong Yin.

It was a new experience for Li to move from biochemistry to purely chemical experimental research, focusing on magnetic assembly.

During the five and a half years of his Ph.D. studies, Li has been working on synthesizing nanomaterials, and then magnetically assembling nanomaterials of different shapes and sizes into complex structures with different functions. In his own words, "The accumulation of several years has engraved the magnetic field into my brain, and no matter what problem comes to my mind, I will naturally associate it with the magnetic field." As he neared graduation, he finally had his "flash in the pan".

At that time, Li read some literature about chiral phenomenon and realized that chirality exists widely in nature, such as DNA, distribution of amino acids, etc.

Interestingly, if a chiral molecular structure is effective as a drug, the compounds of its mirror molecular structure are often unable to bind to the target molecule, which is ineffective for treatment, and may even become a "poison". While reading, Li Zhiwei naturally thought, "Could the magnetic field be chiral?" He then began to search the literature, but found a blank.

Soon the fledgling thought was almost annihilated, "It sounds simple and unbelievable. If the magnetic field distribution also follows chirality, then why didn't previous generations discover it after all these years?" And so, under the pressure of his graduation defense, he shelved the idea.

Li Zhiwei and his families

Time came to 2020, affected by the epidemic, Li Zhiwei finally decided to continue to do postdoctoral work in this laboratory. He began to work on experimental verification.