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Sleeping Beauties

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Whatever can be conceived, sooner or later can be done.

As every child knows, a beautiful princess put to sleep by an evil fairy was woken up by the kiss of a prince. If it were not for him, she would probably still be fast asleep and all children would be sad. Strange as it sounds, such sleeping beauties also exist in the world of research, just waiting for a prince to bring them out of their slumber.

The term “sleeping beauty” is used to describe good ideas that end up languishing in the research literature without any attention, but then suddenly rise to popularity years later. I myself have witnessed similar cases. Jan Bodnar, then one of my doctoral students, developed a theoretical model of the semiconductor Cd_3As_2 back in the 1970s and presented it at a conference in Warsaw. Cadmium arsenide was then not popular and his paper went nearly unnoticed for years. Recently, however, Cd_3As_2 has proved important, his theoretical model has gained significance and is now in frequent use. I also remember a Romanian physicist who delivered papers about amorphous (noncrystalline) semiconductors at every international conference back in the 1960s and 70s. No one was concerned with such materials back then, and his papers were considered curiosities. When amorphous materials suddenly turned out to have important applications, throngs of physicists rushed to study them but the Romanian was completely forgotten. In 1985 two Russian physicists presented an unexpected result at a conference in the United States. Everyone (including me) nodded their heads with interest and then promptly forgot about the whole thing. In 2005, two Americans presented the notion of topological insulators, which would open up a new field in semiconductor physics. Then some of us remembered those Russians saying something similar 20 years before. This time, the topic had fallen on fertile ground.

Each of these cases has slightly different causes, but each is typical in its own way. Stories similar to the Cd_3As_2 case happen often: an avenue of research once thought insignificant simply turns out to be important some time later. The amorphous materials story is a model case more reminiscent of the world of fashion. The Romanian physicist was ahead of his time, a precursor, but he was kind of a weirdo who wears slim-leg trousers when everyone else is wear-

ing flares. One has to be lucky with the right timing. Coming too early is almost as futile as coming late, because in both situations you are alone. So what if the Viking explorer Leif Erikson reached America in the tenth century? No one was ready for it, prepared to take advantage of such a great discovery, so it went unnoticed. It was Columbus’s discovery that changed the world, because the late fifteenth-century world was ready for a new beginning.

The case of the topological insulators, in turn, illustrates a certain historical regularity. My American boss at MIT used to say: “If it can’t be tested experimentally tomorrow, it’s not worth studying.” But scientists in the former Soviet Union, where not much could be tested experimentally, took the completely opposite approach. If they had a new idea, they would discuss it and publish the conclusions, unconcerned about whether it could be tested at that time. As a result, it became a widespread conviction among the scientific community that anytime someone came up with a new idea, the Russians had surely already published something about it. Their weakness proved to be a strength.

The issue has another side to it, which I will illustrate with my own example. In the 1980s I submitted a theoretical paper for a conference in Grenoble, about two-dimensional electron gas. The organizers rejected it, saying that it was not currently possible to observe the proposed effect. Two months later I found out that “my” effect had just been observed at the famous Bell Labs outside of New York. In three days I wrote the paper up and submitted it, in order to beat the Americans. I learned one thing on that occasion: one should not get discouraged by claims that something is undoable, because perhaps someone is trying to do it at that very moment. If not now, then maybe in five years. Whatever can be conceived, sooner or later can be done. The princess may sleep awhile, but a prince will come.

Science is rushing ahead at an astonishing pace. Fashions and interests change so quickly, there is so much information, that it is easy to overlook good ideas if they do not quickly find confirmation. This not only delays progress, it also hinders the development of important applications. We must not let the beauties slumber. ■