IAS
The Institute Letter

Institute for Advanced Study Spring 2011

DNA, History, and Archaeology

BY NICOLA DI COSMO

Historians today can hardly answer the question: when does history begin? Traditional boundaries between history, protohistory, and prehistory have been blurred if not completely erased by the rise of concepts such as "Big History" and "macrohistory." If even the Big Bang is history, connected to human evolution and social development through a chain of geological, biological, and ecological events, then the realm of history, while remaining firmly anthropocentric, becomes all-embracing.

An expanding historical horizon that, from antiquity to recent times, attempts to include places far beyond the sights of literate civilizations and traditional caesuras between a history illuminated by written sources and a prehistory of stone, copper, and pots has forced history and prehistory to coexist in a rather inelegant embrace. Such a blurring of the boundaries between those human pasts that left us more or less vivid and abundant written records, and other pasts, which, on the contrary, are knowable only through the spadework and fieldwork of enterprising archaeologists, ethnographers, and anthropologists, has also changed (or is at least threatening to change) the nature of the work of professional historians.

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"Spontaneous Revolution" in Tunisia
Yearnings for Freedom, Justice, and Dignity

BY MOHAMED NACHI

Protests in Tunisia culminated when Zine el-Abidine Ben Ali, who had ruled for twenty-three years, fled on January 14, 2011.

The Tunisian revolution of 2011 (*al-thawra al-tunisiya*) was the result of a series of protests and insurrectional demonstrations, which started in December 2010 and reached culmination on January 14, 2011, with the flight of Zine el-Abidine Ben Ali, the dictator who had held power for twenty-three years. It did not occur in a manner comparable to other revolutions. The army, for instance, did not intervene, nor were there actions of an organized rebellious faction. The demonstrations were peaceful, although the police used live ammunition, bringing the death toll to more than one hundred.

The demonstrations began in the town of Sidi Bouzid, west of the country's geographical center. On December 17, 2010, a young street vendor set himself on fire following the confiscation of his wares (fruits and vegetables) by the police. Mohamed Bouazizi was twenty-six, and he succumbed to his burns on January 4. The next day, five thousand people attended his funeral. He became the symbol of the liberation of the Tunisian people from the despotic rule of the Ben Ali regime. The population, and predominantly the

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Knots and Quantum Theory

BY EDWARD WITTEN

In everyday life, a string—such as a shoelace—is usually used to secure something or hold it in place. When we tie a knot, the purpose is to help the string do its job. All too often, we run into a complicated and tangled mess of string, but ordinarily this happens by mistake.

The term "knot" as it is used by mathematicians is abstracted from this experience just a little bit. A knot in the mathematical sense is a possibly tangled loop, freely floating in ordinary space. Thus, mathematicians study the tangle itself. A typical knot in the mathematical sense is shown in Figure 1. Hopefully, this picture reminds us of something we know from everyday life. It can be quite hard to make sense of a tangled piece of string—to decide whether it can be untangled and if so how. It is equally hard to decide if two tangles are equivalent.

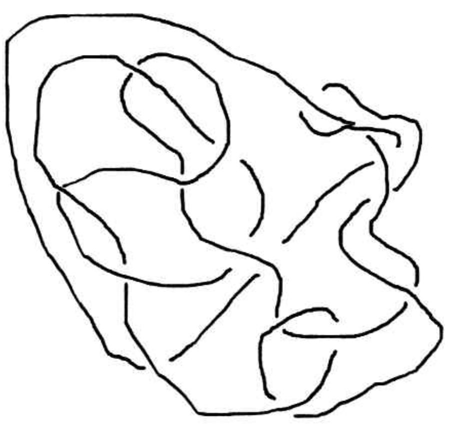

Figure 1

Such questions might not sound like mathematics, if one is accustomed to thinking that mathematics is about adding, subtracting, multiplying, and dividing. But actually, in the twentieth century, mathematicians developed a rather deep theory of knots, with surprising ways to answer questions like whether a given tangle can be untangled.

But why—apart from the fact that the topic is fun—am I writing about this as a physicist? Even though knots are things that can exist in ordinary three-dimensional space, as a physicist I am only interested in them because of something surprising that was discovered in the last three decades. Much of the theory of knots is best understood in the framework of twentieth- and twenty-first-century developments in quantum physics. In other words, what really fascinates me are not the knots per se but the connections between the knots and quantum physics.

The first "knot polynomial" was actually discovered in 1923 by James W. Alexander. Alexander, a Princeton native who later was one of the original Professors at the Institute, was a pioneer of algebraic topology. But the story as I will tell it begins with the Jones polynomial, which was discovered by Vaughan F. R. Jones in 1983. The Jones polynomial was an essentially new way of studying knots. Its discovery led to a flood of new surprises that is continuing to this very day.

Even though it is very modern, and near the frontier of contemporary mathematics, the Jones polynomial can be described in such a down-to-earth way that one could explain it to a high school class without compromising very much. There are not many frontier developments in modern mathematics about which

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