An enzyme (pink) places a chemical mark (gold) on messenger RNA (blue), in an artist's concept.

axons to regenerate after nerve injury. The modification also enhances memory. When He's team knocked out the gene for an m^6A reader in mice, the otherwise normal animals had memory defects. Injecting a virus carrying the normal reader gene reversed the effect. And when the researchers chemically stimulated the neurons to mimic the addition of a new memory, they saw a burst of protein synthesis that depended on m^6A, they reported last year in *Nature*.

Several years ago, Oberdoerffer followed a hunch that cells might use another simple chemical unit, an acetyl group, on mRNA. Her team reported last year in *Cell* that many mRNA cytosine bases are acetylated. The change boosts translation by stabilizing the molecules, and perhaps also by helping mRNAs match up with the correct transfer RNAs (tRNAs), the small RNA molecules that read the mRNA and add an amino acid to a growing protein chain. When mRNA and tRNA complement each other, they bind, triggering the addition of the amino acid. But the system isn't exact—there are many more possible mRNA sequences than there are tRNAs, so tRNAs must somehow find (and bind to) some mRNAs that don't match.

Oberdoerffer's team found a clue to the mystery: an acetylated mRNA base often sits where a tRNA must recognize the mRNA despite a mismatch. The RNA modification's presence dramatically boosts gene translation, the researchers found. Oberdoerffer doesn't think the modification is necessary for correct mRNA-tRNA recognition, but it may strengthen binding. "I think we will learn that the genetic code as we know it is not a static entity," she says.

Like other fledgling areas of research, RNA epigenetics (also known as epitranscriptomics) has its skeptics. In 2016, one group reported in *Nature* it had found a new modification, m^1A, at more than 7000 sites across a cell's complement of mRNAs. But a year later in the same journal, another group claimed that at most 15 mRNA m^1A sites exist. "Because of that, everyone in the molecular biology community is a little bit suspicious about the validity of these [mRNA] modifications," Jaffrey says.

Other disputes rage over the functions of key enzymes and reader proteins. But epitranscriptomics is evolving fast. "We just need … a lot more knowledge about these things," He says. "We need to stay open minded. The field is still very young." ■

Ken Garber is a journalist in Ann Arbor, Michigan.

PHOTO: COURTESY OF LEON LEVY EXPEDITION TO ASHKELON

ARCHAEOLOGY

DNA reveals European roots of the ancient Philistines

3000-year-old burials identify the enemies of the biblical Israelites and shore up legends of Bronze Age migration

By **Ann Gibbons**

As a schoolgirl in Israel, Michal Feldman learned that the ancient Philistines, who lived between present-day Tel Aviv and Gaza during the Iron Age, were "the bad guys." In the Bible, they were the archenemies of the Israelites, who fought Samson's armies and sent Goliath into battle against David. "Philistine" is still a slur for an uncivilized barbarian.

Now a Ph.D. student in Germany, Feldman has found a new way to understand the Philistines. By analyzing DNA from 12th century B.C.E burials in the Philistines's renowned city of Ashkelon, her team has found that they were interlopers in the ancient Middle East. Their closest known kin were from southern Europe, the team reports this week in *Science Advances*.

Infant burials beneath Philistine houses in Ashkelon, Israel, yielded ancient DNA.

The DNA data suggest a kernel of truth to Greek and Middle Eastern legends that describe survivors who moved south after the catastrophic collapse of great Bronze Age civilizations of the Mediterranean in the late 13th and early 12th centuries B.C.E. "This [DNA] story of migration is tantalizingly close to those memories," says co-author Daniel Master of Wheaton College in Illinois, who leads excavations in Ashkelon, Israel. "This is about real people who are moving from real troubles, finding new families in a new home," adds Assaf Yasur-Landau, an archaeologist at the University of Haifa in Israel who was not part of the study. "It's the most basic human story."

Archaeologists have known for a century that the distinctive ceramic pots and other artifacts that suddenly appeared in 12th century B.C.E. Philistine cities resemble artifacts from the Mycenaean empire of Greece, the ancient power that, according to myth, battled Troy. Egyptian hieroglyphics depict a sea battle with people from the north whom 19th century scholars called the "Sea Peoples." But other scholars think Philistine culture spread when ancient empires in Turkey and Syria declined and local people filled the void.

Master invited Feldman's adviser, paleogeneticist Johannes Krause of the Max Planck Institute for the Science of Human History in Jena, Germany, to try to extract DNA from the teeth and inner ear bones of skeletons excavated in Ashkelon. The team analyzed 1.24 million sites across the genomes of 10 skeletons. Three of the oldest individuals, who lived 3500 to 3700 years ago, were not distinguishable genetically from local Levantine people. But DNA from four infants buried beneath the earthen floors of homes in Ashkelon 500 years later, when Philistine culture first appears, told a different story. They had inherited 25% to 70% of their DNA from southern European ancestors, and the closest matches were to ancient people from the Aegean, Sardinia, and Iberia. The remaining DNA was from local people, suggesting their European ancestors had quickly mated with their new neighbors. Indeed, two styles of pottery in neighboring houses suggest that Philistines and Levantines lived side-by-side in Ashkelon.

Just 200 year later, however, the DNA of three adults, presumably Philistines, fully matched that of local Levantine people. Intermarriage had swamped the genetic heritage of the European immigrants, Krause suggests.

With the study "we finally have real scientific proof that people moved into Ashkelon from Europe," says Kristian Kristiansen, an archaeologist at the University of Gothenburg in Sweden, who suspects they hailed from Italy. But it will take ancient DNA from across southern Europe to pinpoint their homeland. ■