Elderly women in Shanghai, China, suffering from dementia, one of the diseases the new effort may tackle.

sity here. The city of Beijing and local institutions took the initiative and launched the Chinese Institute for Brain Research, announced on 22 March; Beijing is putting up much of the funding for the institute. It and the Shanghai center "aim to become world-class research institutes for brain research," says Luo Minmin, a neuroscientist at the National Institute of Biological Sciences in Beijing and co-director of what will be the northern center.

The Shanghai center will "integrate and expand" ongoing efforts, Zhang says. The city's Huashan Hospital, long a center for neurosurgery, is already building a new facility dedicated to clinical neuroscience, he notes; CAS and the city of Shanghai also put up money for a brain mapping project in 2012 and a scheme to get area brain researchers to collaborate in 2014. The region hosts budding commercial efforts to develop brain-inspired technologies. Zhang estimates some 1 billion yuan ($157 million) annually has been flowing into brain-related research here in recent years.

Although the new center will start recruiting its own research teams later this year, Zhang says, many of its principal investigators will have dual appointments and keep labs at their current institutes. The center will provide a mechanism to share pricey equipment and will establish a database to gather research and clinical information not currently being shared. International cooperation will be a priority.

Once the national effort is underway, the two new centers are likely to become its northern and southern hubs. Researchers expect a high-level committee to set priorities, but the two centers will retain a degree of autonomy. In Beijing, for instance, "we are encouraged by the Board of Trustees, which is led by the Beijing municipal government, to do whatever we think is important," Luo says.

As for the overall project, Yang urges a step-by-step approach. "Given the ambitious scope of the project and the relatively limited resources in China, I don't think it is realistic to start the project all at once."

The next step just might be the launch of Poo's proposed connectome project. It was the topic of a 2 May symposium in Beijing organized by the science ministry. But as for when it might be approved, "I am not at liberty to make any statement at this moment," Poo wrote in an email to *Science*. ■

With reporting by Bian Huihui in Shanghai, China.

PHOTO: ISTOCK.COM/D-KEINE

ETHICS

German law allows use of DNA to predict suspects' looks

Bavaria opens the door to DNA phenotyping, provoking debate about the technique's ethics and accuracy

By **Gretchen Vogel**, *in Berlin*

Police in the German state of Bavaria now have the authority to analyze forensic DNA samples to predict the geographical ancestry and physical characteristics—hair color, eye color, skin color, and age—of an unknown suspect who poses an imminent danger. The controversial law, which passed the Landtag, the state parliament in Munich, on 15 May, is the first in Germany to allow what has been dubbed DNA phenotyping, and it has sparked renewed debate here and in other countries about the advantages—and risks—of such methods.

German federal authorities, and police in the country's 15 other states, are only allowed to perform DNA fingerprinting, in which they look for an exact match between crime scene DNA and samples in a database of known criminals or from a suspect. DNA phenotyping and ancestry prediction, however, have been used in the Netherlands, France, the United Kingdom, Canada, and several U.S. states. Some of those jurisdictions have explicit laws permitting and regulating the practice. In others, police have begun to use DNA phenotyping without explicit regulation. Well-publicized success stories—and advances in the science—have fed interest in the method. Switzerland, like Germany, does not allow such use of DNA, but lawmakers there are considering reversing that ban.

Some critics caution that although the underlying science connecting genetic markers to certain physical features is solid, DNA phenotyping and ancestry prediction can still be easily misunderstood by police and the public. Proponents "exaggerate the numerical certainties," says Veronika Lipphardt of the Albert Ludwigs University of Freiburg in Germany, who studies the history and uses of population genetics. "That creates the impression that it's clear-cut what race someone is or where someone comes from, and that's not true." One U.S. company is even using DNA phenotyping to create facial sketches of suspects, which goes beyond what many scientists now consider credible.

"You would need a lot of training of police forces to use [DNA phenotyping] responsibly," says legal scholar Carsten Momsen of the Free University of Berlin, who worries the technique could lead to the targeting of minority groups. Bavaria's new law doesn't cover investigations of crimes that have already been committed; those are still ruled by federal law. Instead, it allows DNA phenotyping in situations of "imminent danger," when police suspect someone is planning a serious crime. For example, authorities

Traces of DNA from items at a crime scene can predict a person's hair, eye, and skin color—and more, some say.

could analyze trace DNA found on stashes of weapons or bombmaking materials. The uncertainties in the technique can be especially problematic in such high-pressure situations, Momsen says.

Geneticist Manfred Kayser of Erasmus University Medical Center in Rotterdam, the Netherlands, who has developed several of the DNA phenotyping techniques permitted under the new Bavarian law (*Science*, 18 February 2011, p. 838), acknowledges that "there has to be education and training involved. You have to be able to work with probabilities." Still, Kayser notes that police constantly have to decide how trustworthy various kinds of evidence are. At least investigators can quantify the uncertainty in results from DNA analyses, he says. "With eyewitness testimony you have no idea if it's right or wrong."

The techniques attempt to wring information out of traces of blood, skin, semen, or other DNA-containing cells found at a crime scene. They read single-nucleotide polymorphisms (SNPs), individual DNA bases that can vary between people and directly influence or correlate with differences in certain physical features. From databases of SNP variants and people's appearances, scientists can build computer models that predict someone's likely hair, eye, and skin color from their DNA. They can also use age-related chemical changes in DNA to estimate a person's age to within about 4 years.

> ***"You would need a lot of training of police forces to use [DNA phenotyping] responsibly."***
>
> **Carsten Momsen**, Free University of Berlin

The accuracy of the results depends on several factors, including the quality—and quantity—of the sample tested and whether the genetic variants found in the sample are well-represented in the model databases. Kayser and his colleagues in Rotterdam and at Indiana University-Purdue University Indianapolis recently released their latest iteration of a tool called HIrisPlex-S. The test returns probabilities for three eye colors (blue, brown, or green/hazel); red, blond, brown, or black hair; and five skin shades, ranging from "very pale" to "dark-black."

In April, they reported in *Forensic Science International: Genetics* that the test correctly predicted all three characteristics for 17 out of 19 simulated crime scene samples. (Two samples did not have high enough quality DNA to make a prediction.) The test also correctly identified five out of six other samples as having cells from two or more people, although it could not say what they looked like. Police in the Netherlands and France have used the test for eye and hair color in several cases. Ancient DNA researchers have also used it to predict characteristics of people known from archaeological remains.

Going beyond skin, hair, and eye color to predicting geographical ancestry is harder. Computer programs can compare a suspect's SNP patterns to those in databases from multiple populations. But some populations may be missing from the databases and others may be indistinguishable because of mixing. Telling whether a person's ancestors were East Asian, African, Native American, Western Eurasian, or from Oceania is fairly straightforward. But predicting whether someone has northern European versus Middle Eastern ancestry is sometimes impossible.

Still more controversial is Parabon NanoLabs in Reston, Virginia, a company that generates facial shape profiles in addition to skin, eye, and hair color and geographical ancestry. Ellen Greytak, its director of bioinformatics, says the firm starts with a standard face based on the person's DNA-derived ancestry and sex. Further analysis of genetic markers leads to a face that "emphasizes the features we predict will be distinctive" about the person, she says.

That goes too far, Kayser says. "The science is not there at all." The company has not published its methods or systematic validation tests, he notes. Greytak says the company doesn't claim to produce an exact portrait. "It's not going to point to an individual. It's going to exclude people. ... The vast majority of people are not going to fit the description." The company's website describes several cases where its phenotyping helped authorities find a culprit.

Ironically, DNA phenotyping might have been of little use in the case that helped prompt the new Bavarian regulations. In late 2016, a medical student was raped and murdered in Freiburg; an asylum seeker, originally from Afghanistan, was convicted of the crime. But some authorities complained that they could have narrowed their search more quickly if they had been able to use trace DNA to predict what the culprit looked like and where they might be from.

The crucial evidence in the Freiburg murder case, however, was nongenetic: a strand of hair with an unusual dye pattern—dark at the root, blond at the ends. Police spotted the suspect, who had the same dye pattern, in surveillance video from a tram stop near the crime scene. A DNA test would have only indicated dark hair, not enough to pick out the suspect in the video footage. Kayser agrees that the case wasn't well suited to argue for a law to allow DNA phenotyping. "It was the wrong case to make that claim," he says. ■

PLANETARY SCIENCE

B612 plans asteroid hunt with fleet of small satellites

After abandoning plans for a large space telescope, private foundation pins hopes on new technologies

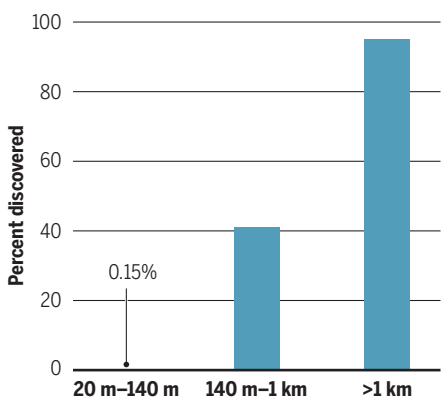
By **Adam Mann**

Last week, an asteroid the size of Egypt's Great Pyramid of Giza whizzed by Earth, missing it by half the distance to the moon. The concern that we may one day not be so lucky has long preoccupied the B612 Foundation, a private organization in Mill Valley, California, dedicated to finding asteroids that cross Earth's orbit and could devastate humanity. B612 itself had a near-death experience 3 years ago, when its bold plans for an asteroid-hunting space telescope fell apart. But now, its ambitions are rising again with a new technique for finding menacing objects.

On 10 May, B612 announced a partnership with York Space Systems, a Denver-

On the hunt

Congress has tasked NASA with finding 90% of near-Earth asteroids bigger than 140 meters. Most of the biggest are known. Organizations like the B612 Foundation are trying to make progress on smaller ones.



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