

# CAUTION – TOXIC GREEN!

TEXT: CLAUDIA DOYLE

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For humans, plants are a source of food, building material, and medicine. But not everything that is green is good. Some plants produce toxins that can make us sick – or even kill us. Thus, a wariness of plants makes sense from an evolutionary point of view, especially for infants and toddlers. Annie Wertz from the Max Planck Institute for Human Development in Berlin is investigating which behaviors protect children from dangerous plants and how they learn from adults which plants are safe to eat.

As Annie Wertz was jogging through the mountains in California one day, an unpleasant thought came to her: if she were to get injured or lost in that moment, that would be the end of her. She would starve to death. But the then doctoral researcher from the University of California, Santa Barbara was surrounded by trees, ferns, and grasses. A veritable cornucopia of nourishment. But she had no idea which plants were edible and which were poisonous. She had never learned this life-saving information.

This realization gave her an idea. In western cultures, most food comes from the supermarket. Only a few people still cultivate their own food or forage for wild plants. But for the greater part of human history, foraging for plants and hunting animals has ensured a sufficient supply of food. Our ancestors once had extensive knowledge of which plants were edible and how to best prepare them. They passed on this wealth of experience to their descendants. “It would have been a deadly endeavor if each individual had to find out for themselves which plants can be eaten and which ones cannot,” says Wertz. The psychologist has since left California and has been heading the “Naturalistic Social Cognition” research group at the Max Planck Institute for Human Development in Berlin since January 2015. There, she researches the evolutionary strategies that enable infants and toddlers to safely learn about plants.

When Wertz talks about her project at conferences, she often receives skeptical looks. But her research question is

by no means a niche topic. “Which plants around me are edible, which ones can kill me, and how can I distinguish one from the other – these are crucial questions that have ensured our survival throughout human evolution,” says Wertz. Humans are curious by nature, and especially in the first months of life, they have an insatiable urge to discover and explore many objects with their mouths. At this age, the tongue has a particularly large number of nerve cells. But when it comes to exploring plants, this strategy alone could be fatal; after all, quite a few plants are inedible – or even deadly – for humans. “Humans have always co-existed with plants. Therefore, strategies that facilitate safe co-existence should have emerged during the course of evolution,” says Wertz.

Whether a plant has the potential to become your favorite food or your last meal can’t be deduced from its looks alone. White flowers? This could indicate a harmless apple tree or the poisonous wood anemone (*Anemone nemorosa*). Blue fruit? This applies to





PHOTO: IM AGO IMAGES/DANITA DELIMONT

From tree to mouth:  
children learn to  
distinguish between edible  
and poisonous plants at a  
young age – like this girl in  
the Ecuadorian rain forest.



PHOTOS: MPI FOR HUMAN DEVELOPMENT



Dried fruit from the tree: in this experiment, the child had observed an adult picking orange dried fruit from a real plant and purple fruit from a silvery artificial plant and eating it. Like most of the children in the test, this child reaches for the fruit that comes from the real plant.

both delicious blueberries and the poisonous buckthorn. Even mechanical defense mechanisms such as thorns are found in both edible and poisonous plants. Therefore, infants and toddlers should ideally be wary of all plants from birth, so that they do not accidentally put a poisonous plant in their mouths. With this thesis, Wertz started her postdoctoral position in 2009 with Karen Wynn at Yale University. To test their theory, she invited parents and their infants to the laboratory. The infants, aged eight to 18 months, sat on their parents' laps and were presented with different objects one after the other.

These objects were green potted plants, like parsley or basil, as well as artificial plants. There were also novel man-made objects, which were matched to the characteristics of the plants. "We designed these objects so that we could rule out the possibility that the infants would simply avoid any green object or objects with a plant-like shape," explains Wertz. Finally, natural materials (e.g., shells) and everyday objects (e.g., spoons) were used. In general, the infants wanted to touch all the objects. But there were big differences in the speed at which their little hands reached out for them. The infants hesitated for only three to five seconds when it came to natural materials, everyday objects, and the objects that were modeled after plants. On the other hand, it took about twice as long for the infants to reach out toward the real and artificial plants.

## Five seconds more to intervene

"With this study, we showed for the first time that infants are reluctant to touch plants," says Wertz. This could be an evolutionary strategy to protect young children from poisonous plants. At first glance, a five-second

delay does not seem long. However, this small window of opportunity could well give parents enough time to intervene and prevent their children from coming into contact with the plant. This effect was independent of the age of the children. "That surprised me," says Wertz. "I had expected that there might be greater differences as children became more mobile." In a second experiment, Wertz found out that when it comes to deciding what can serve as a food source, young children distinguish between plants and artificial objects, learning through observation that you can eat fruits from plants, but not artificial objects. Toddlers aged 18 months watched as an adult picked dried fruits attached to a potted plant and put them in their mouth. The same procedure was repeated with dried fruits that were attached to a silvery artificial plant. The adults then picked the remaining dried fruits from a living plant as well as from the silvery artificial plant and presented them to the children – most of whom chose the fruits that came from the real plant.

These first two experiments laid the foundation for Wertz's research work, which she is now expanding upon in her own research group. She has already been able to demonstrate that, to a certain extent, toddlers can abstract information about the edibility of plants. For example, if they observe that an adult eats an apple from an apple tree, they learn that they can eat the apples from other apple trees as well. This kind of generalization makes learning about food much more efficient. But it is a tremendous achievement to be able to recognize an apple tree among a variety of trees. Wertz now wants to identify which characteristics infants use to categorize an object as a plant and to distinguish between different types of plants. It does not seem to depend on one characteristic alone but rather on the sum of many details. This can be

illustrated using the example of color. Although children avoid green plants, they readily touch green objects. Because edible plants vary greatly in appearance, size, smell, shape, and texture, the learning process is also complex. When learning to use tools, children tend to pay more attention to shape. But when learning about the edibility of food, they seem to prefer neither specific shapes nor specific colors. This is only logical if you consider the differences between blueberries, kiwis, and oranges, for example – although all of them are edible.

## Distrust of vegetables

Despite all their curiosity, many children eventually develop an aversion to vegetables. Many toddlers push broccoli florets off their plates in disgust or listlessly poke around at their carrots. This strong aversion to new foods is particularly common with vegetables, and is referred to as food neophobia. Together with post-doctoral fellow Camille Rioux, Wertz wanted to test whether it was possible to detect the basis for this aversion in infancy.

To this end, children aged between 7 and 15 months were presented with plant-based foods at various stages of processing: whole fruit still on the plant, picked fruit, fruit cut into strips or slices, and heavily processed, plant-based foods such as rice wafers. Control objects were also used, such as a sponge shaped like a fruit. Once again, the infants hesitated longer before touching plants and the picked and sliced plant-based foods than they did for the heavily processed foods and the control objects. The infants also looked for more eye contact with their caregivers, possibly to learn about the correct behavior when dealing with the plant-based foods. One year after the experiment, the

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Set up for children: psychologist Annie E. Wertz in the BabyLab.

parents completed a questionnaire about their child's neophobic behaviors toward food. It emerged that the children who had hesitated the longest to touch sliced pieces of fruits and vegetables had a more pronounced aversion to these foods one year later. Parents with picky toddlers can therefore breathe a sigh of relief. It is not all upbringing – some children seem to be more careful from the very beginning.

## Contact with plants from early infancy

But do these results apply to infants all over the world? Cross-cultural studies are needed to find out. Unlike in the U.S. or Germany, many children in other societies still live in close contact with nature and have frequent interactions with plants. With the help of an anthropologist from Victoria University of Wellington, Wertz worked with a population of Indigenous Fijians known as iTaukei. These families live with and from nature, and most of them also grow their own food. Infants and toddlers in this culture also showed wariness of plants. But there was one major difference. While children from Western societies typically avoid all plants, iTaukei children showed this behavior only with plants they did not know. "These children have presumably observed adults interacting with certain plants quite often and therefore know that these plants are safe," says Wertz. Children from Western societies often lack this kind of experience.

In a second cross-cultural project, Wertz, in collaboration with anthropologists from the University of California, Los Angeles, is investigating Indigenous Shuar children in Ecuador. Here too, she would like to find out how the cultural context influences children's behavior towards plants. The results so far suggest that infants' avoidance

behavior towards plants is deeply anchored in the brain. Could it be that even primate species related to humans show similar behavior? After all, they too face the same challenges when it comes to determining which plants are food and which are deadly. Wertz and her post-doctoral fellow Linda Oña are currently investigating this question in five non-human primate species. However, Annie Wertz' innovative and still growing research program suggests that learning mechanisms have developed through evolutionary processes.



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### SUMMARY

Infants and toddlers take much longer to reach for plants than for other objects.

By observing adults, they learn that certain plants or their fruits are edible.

Infants and toddlers outside industrialized societies who live in close contact with nature avoid only the plants they do not know.

Experiments have shown that toddlers who have an aversion to fruit and vegetables were also particularly wary of slices of plant-based foods as infants.

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*"Insight must precede application."* Max Planck

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