

Conscience grows on temperamental ground

Pundits and policy makers frequently call on parents to instill morality in their children, often implying that this trait can be learned by rote, like the multiplication tables. A long-term study of preschoolers now indicates that, to the contrary, the moral beacon known as a conscience develops in different ways, with critical contributions from both a child's natural approach to the world and specific parental practices.

A good fit between a youngster's temperament and a mother's child-rearing style fosters the ability to tell right from wrong and to act accordingly, at least from ages 2 to 5 1/2, argues psychologist Grazyna Kochanska of the University of Iowa in Iowa City.

In fearful children, who display considerable caution, shyness, and anxiety, conscience establishes a beachhead if they receive gentle discipline that puts encouragement over threats, Kochanska says. The overall quality of their relationship with their mother does not appear to play a role.

In fearless kids, who exhibit an outgoing, curious approach to the world, conscience takes root in the presence of a cooperative, emotionally secure relationship with their mother. The child will then heed the mother's direct suggestions for improving behavior, Kochanska explains. When these children do not have a close relationship with their mother, they show less conscience.

"As they move through the preschool period, [fearful children] may internalize rules and norms more rapidly than fearless children," the Iowa scientist remarks. "If replicated in another sample, this [research] approach may help to elucidate some of the central questions of socialization."

Kochanska's study, published in the March *DEVELOPMENTAL PSYCHOLOGY*, consists of 43 girls and 47 boys observed at ages 2 1/2, 4, and 5, give or take several months. Children and their mothers were mostly white and came from families with a wide range of incomes.

At the youngest age, temperament was assessed through mothers' reports and the child's responses to an experimenter's suggestions to play with various lab toys.

Maternal responsiveness and disciplinary style, as well as the child's sense of security and dependence on her, were also rated after observations of their interactions in laboratory sessions.

At the two older ages, Kochanska assessed each child's conscience level in part on his or her ability to resist temptations to cheat during several laboratory games. For instance, children had 3 minutes by themselves to guess which three animals were hidden under pieces of cloth by touching them with

one finger, without peeking. An experimenter first explained to each child what cheating means and stressed the importance of not cheating.

Conscience ratings also rested on kids' solutions to hypothetical moral dilemmas, such as whether to ignore a bully or to aid his victim.

Fearful children may spontaneously feel anxious at even the thought of wrongdoing, making them relatively quick to develop a conscience, Kochanska suggests. Fearless youngsters ignore gentle discipline but develop a strong conscience if they have a close relationship with a responsive mother, a tendency the Iowa researcher plans to examine

Swapping insulin syringes for tiny beads

Coating insulin with a layer of plastic the width of a few human hairs could allow diabetics to swallow the medicine that they now must inject several times daily. Such plastic coverings can protect a variety of fragile drugs that would otherwise fall apart on their trip through the stomach, scientists report this week.

In tests involving a range of drugs, researchers found that beads successfully carried molecules of various sizes—a tiny blood coagulant, medium-sized insulin, and relatively massive DNA molecules—into rats' bloodstreams, says Edith Mathiowitz. The molecular biologist and her colleagues at Brown University in Providence, R.I., developed and tested beads made of a polyanhydride copolymer of fumaric and sebacic acid that is similar to the casing of ballpoint pens. The results of their work appear in the March 27 *NATURE*.

Scientists have been searching for better ways to deliver protein-based drugs, such as insulin, and other molecules, like DNA, that cannot withstand contact with digestive enzymes. They have manufactured injectable microspheres for delivering proteins (SN: 7/27/96, p. 63), and DNA has been encapsulated in microspheres of an erodable biopolymer called PLG, then successfully fed to mice (SN: 5/11/96, p. 302). Mathiowitz's approach now makes possible oral delivery of medicine in a package that can cling to specific tissues.

The spheres' small size, ranging in diameter from 0.3 to 2 micrometers, allows them to slip between cells and bury themselves in the intestinal walls. Once attached to the tissues, the spheres' shells erode, slowly releasing the contents into the bloodstream.

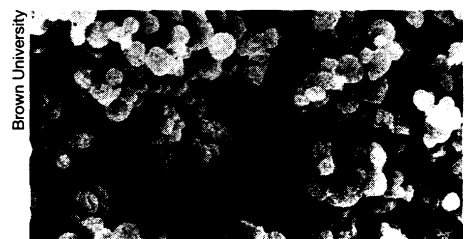
Mathiowitz and her team of researchers were surprised by the spheres' ability to move through the body. "They can really pass through and penetrate the bloodstream," Mathiowitz says. The scientists wrapped gold in the plastic, then fed the

more closely in future research.

Peer and teacher influences on conscience undoubtedly start to grow in strength at about age 5, she notes.

"This study is a nice demonstration of an interaction between childhood temperament and socialization," says psychologist Avshalom Caspi of the Institute of Psychiatry in London.

In the same journal, Caspi and his coworkers report that extremely inhibited or impulsive 3-year-olds encounter many more interpersonal problems as young adults than do somewhat reserved or moderately outgoing 3-year-olds, perhaps indicating that personality development diverges among both fearful and fearless kids depending on how well they mesh with a variety of social influences. —B. Bower



Dark shapes indicate gold encased in plastic between cells in the intestinal lining of rats.

spheres to rats. When the scientists tracked the gold markers with an electron microscope, they found that some spheres reached the spleen and liver—beyond the expected final stop at the intestinal walls.

Before diabetics can use microspheres instead of syringes, the scientists want to discover a way to make the spheres stick to the intestinal walls. They must also learn how to control the rate of drug release from the beads, Mathiowitz says. "If we can understand the mechanics, I'm sure we can work it out."

Solving those problems could improve the quality of life for the approximately 4 million people in the United States who inject insulin, says Philip E. Cryer, president of the American Diabetes Association in Alexandria, Va.

Robert Langer, a chemical engineer at the Massachusetts Institute of Technology, says the new study gives "real insight" into how bioadhesive microspheres are taken up by tissues. He calls the possibilities of the beads' use in oral gene therapy "potentially very exciting."

Judith H. Greenberg, a geneticist at the National Institutes of Health in Bethesda, Md., says that, although scientists need to answer many questions, the technique holds promise for gene therapy. "It does keep the DNA from being degraded, and it seems to promote getting the DNA into the cell," Greenberg says. —P. Smaglik