Continued from p.233

those New Zealanders displaying negative emotionality and impulsivity at age 18. Three-year-olds classified with these problems later displayed the highest rates of adolescent delinquency, Caspi and his coworkers report in the February CHILD DEVELOPMENT. As teenagers, they acknowledged their pleasure at causing discomfort to others, yet felt mistreated, deceived, and betrayed by those around them.

Impulsivity comes in two forms, Moffitt adds. In the Pittsburgh sample, fourth graders who rated high in behavioral impulsivity — marked by frequent aggression, unplanned acts, and a need for instant gratification — displayed the most delinquency as 12- to 13-year-olds. Cognitive impulsivity, a type of rushed, unfocused thinking that saps concentration and the conscious control of one's thoughts, showed a stronger link to low IQ than to delinquency.

Diminished intelligence, as measured by IQ, may lead to cognitive impulsivity, Moffitt's team argues in the May 1994 JOURNAL OF ABNORMAL PSYCHOLOGY. Conversely, it is also possible that cognitively impulsive kids cannot attend to and absorb information at school that they need to perform well on IQ tests.

However it's measured, impulsivity helps both to groom children for delinquency and to rob them of IQ points, asserts Jack Block, a psychologist at the University of California, Berkeley. In a statistical reanalysis of the Pittsburgh data, Block finds — contrary to what Moffitt and her coworkers reported — that fourth graders scoring high in behavioral impulsivity are much more likely to take up delinquency than those scoring poorly on an IQ test.

Impulsive boys in general register less of the school-imparted information and reasoning logic on which verbal sections of IQ tests depend, the Berkeley psychologist contends in the May JOURNAL OF ABNORMAL PSYCHOLOGY. Not only do these youngsters derive fewer benefits from instruction, but they probably miss more school days than their peers, he argues. Some evidence points to marked jumps in IQ as people spend more time in school (SN: 9/21/91, p.187). Thus, poor school attendance may undermine the IQ of an impulsive youngster, even if the child has a healthy brain, in Block's view.

"Impulsivity fouls up learning and drags down IQ over time," Block maintains.

In contrast, Bruce F. Pennington, a psychologist at the University of Denver, suggests that in many cases of hard-core delinquency, low verbal IQ scores tap into only a small part of a deeper disruption within the brain's frontal lobes. Damage to frontal tissue can produce strikingly poor decision-making and social skills, even if IQ remains unscathed (SN: 5/21/94, p.326). Frontal sites also orchestrate the development of conscience and empathy, both of which prove scarce in many repeat offenders, the Denver psychologist points out.

Current neuropsychological tests, including those given to the Dunedin and Pittsburgh youths, largely miss signs of frontal lobe impairment, he argues.

Twin and adoption studies indicate that a childhood behavioral disorder linked to later delinquency stems in large part from genetic and early environmental influences, according to Pennington. Scientists need to look more closely at how wayward genes and brain damage suffered in the womb, during birth, or in childhood can harm the frontal lobes and lay the groundwork for law-breaking, he says.

Moffitt doubts that a lasting commitment to crime and aggression springs so directly from inheritance or an impaired brain. Impulsive, low-IQ children enter into progressively deteriorating relationships with parents, teachers, and peers, she asserts; this reinforces a life of emotional volatility and lawlessness.

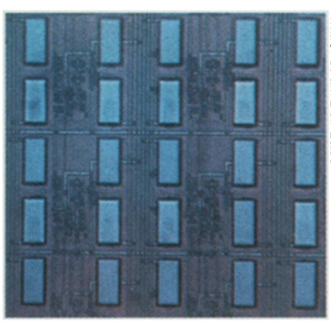
"Public policy that ignores either low IQ or impulsivity as risk factors for delinquency will be ill-informed by social science research," Moffitt remarks. □

Physics

Ivars Peterson reports from San Jose, Calif., at an American Physical Society meeting

Switching with a light touch

Nowadays, a great deal of information travels as pulses of infrared light along optical fibers. Routing and processing this information requires linking optical signals with electronic circuits. Similar capabilities are needed for sending and receiving optical signals via fiber or air between chips or electronic devices, if optical links replace the copper wires conventionally used for making such connections.



Miller et al./Bell Labs

Photograph of an array of optical modulator and detector diodes (rectangular slabs) integrated on a silicon chip to provide optical inputs and outputs for electronic circuits.

As one step toward developing high-capacity optical switches for information processing, David A. B. Miller and his coworkers at AT&T Bell Laboratories in Holmdel, N.J., have demonstrated a practical method for integrating high-performance gallium arsenide-based optoelectronics with high-density silicon-based circuitry on a single chip.

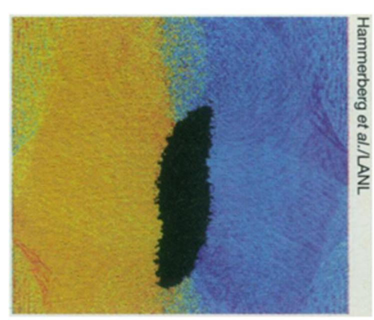
"You start with silicon integrated circuits, and you can put a large number of these so-called quantum well diodes on top of them," Miller says. Moreover, this fabrication method can readily keep pace with improvements in silicon technology.

Each optical diode, about 15 by 45 micrometers in size, can absorb light to generate electric signals on the chip. At the same time, changing the voltage applied to a diode controls how much light it transmits, allowing the diode to emit a modulated light beam. "I can write information into these structures, and I can read it out, using hundreds or thousands of light beams at a time," Miller says.

Metal against metal

The causes and characteristics of friction at the atomic and molecular levels have been the subject of a wide range of studies, including computer simulations (SN: 5/30/92, p.360) and experiments involving atomic force microscopes and other surface-sensing instruments (SN: 12/19&26/92, p.429). Now, researchers have created a computer model showing the behavior of atoms when two metal surfaces slide past each other.

Using this simulation, James E. Hammerberg and his colleagues at the Los Alamos (N.M.) National Laboratory can show how the metals deform, setting off vibrations and creating defects in the atomic structure that spread into the materials. These deformations occur because solid surfaces, no matter how well polished, aren't perfectly smooth. Contact between two surfaces takes place at discrete locations where bunches of atoms protrude. Opposing peaks approach each other so closely that attractive forces bind them together. For sliding to continue, these bonds must be broken.



Hammerberg et al./LANL

Atomic deformations occur as two blocks of copper (one shown in blue, the other in yellow) slide past each other.