Manic depression: Risk and creativity

The rather mysterious relationship between creativity and mood disorders, such as depression and manic depression, is drawing increasing research attention. A recent study, for example, suggested elite creative writers experience more episodes of depression and manic depression than the population at large (SN: 10/24/87, p.262).

Investigators at McLean Hospital in Belmont, Mass., now report a heightened level of "everyday" creativity – encompassing vocational and spare-time pursuits – among people who undergo relatively mild mood swings as well as the healthy relatives of manic depressives. Full-blown manic depressives are less creative than these two groups but show more creativity than control subjects.

"The data suggest that enhanced creativity may be a positive characteristic associated with an inherited liability for manic depression," says psychologist Dennis K. Kinney, who conducted the research with psychiatrist Ruth Richards and several others.

Kinney and his co-workers studied 17 manic depressives, 11 of their parents and siblings with no psychiatric diagnoses and 16 individuals with a mild form of mood swings. Controls had no family history of mood disorders; 15 had no psychiatric disorders and 18 had some diagnosis other than mood disorder, such as anxiety disorder. All the individuals were part of a larger adoption study recently conducted in Denmark.

Extensive transcribed interviews with each participant allowed the McLean researchers to assess creativity with a series of scales designed to tap a variety of work and free-time activities. "We're not trying to measure creative genius," Kinney says. "For instance, creative people in our sample may paint in their spare time, write poetry, start their own business or come up with novel ways to improve their work environment."

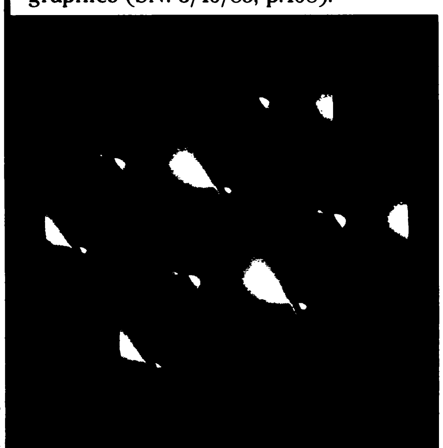
The researchers previously tested the creativity scales with more than 300 psychiatrically healthy subjects from the Danish adoption study. The technique appears to give an accurate estimate of everyday types of creativity, but Kinney notes it is not yet clear if respondents typically exaggerate or downplay their own creative activities.

Individuals with mild mood swings or with manic depressive relatives tend to express their creative potential in different ways, explain the researchers in the August JOURNAL OF ABNORMAL PSYCHOLOGY. Those with manic depressive relatives show the highest creativity in avocational pursuits, while those with mild mood swings are more creative at work. *– B. Bower*

Geometry for segregating polymers

Mixing polystyrene, the stuff of plastic cups, and polyisoprene, a material used for making automobile tires, is like trying to combine oil and water. The two polymers repel each other. However, chemists can bond them together to produce what is known as a block copolymer. Like exhausted adversaries forced to attend a peace conference, the two materials are inextricably linked yet want as little contact with each other as possible.

The question of the geometry of the interface between two linked but repelling polymers turns out to be closely related to the mathematical problem of defining minimal surfaces – surfaces that take up the least possible area within a certain boundary. That connection has led to an unusual collaboration at the University of Massachusetts at Amherst between polymer physicist Edwin L. Thomas, who studies the structure of polymers, and mathematician David Hoffman, who is interested in minimal surfaces and computer graphics (SN: 3/16/85, p.168).



J. T. Hoffman

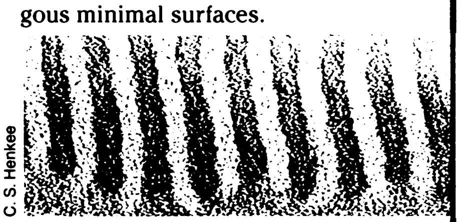
"It was interest at first sight," Thomas says. Hoffman had vivid computer images of both long-known and recently discovered minimal surfaces, and Thomas had electron microscope images of thin slices of polymers. In the Aug. 18 NATURE, Thomas, Hoffman and their colleagues describe three instances illustrating the relationships found between polymer structures and computed minimal surfaces.

In one type of block copolymer, the two constituent polymers form grains consisting of stacks of alternating, equally spaced layers. Because the stacks have no preferred orientation, layers in adjacent grains may meet at any angle. When the layers happen to meet at 90°, electron microscope images – produced from samples in which one of the polymers is doped to make it look darker – show a particular pattern resembling a comb's regularly spaced teeth (see illustration).

That image seems to correspond to a minimal surface known as Scherk's first surface, discovered in 1835 (see color illustration). It can be thought of as the smooth joining of two sets of parallel planes at right angles to each other. Looking at the computed shadow, or projection, of that structure produces a picture closely resembling the polymer image, which itself is a two-dimensional view of the material.

"The match is striking," Thomas says. His group has obtained similar results for a variety of copolymer structures. "We've done this with other polymers, and I'm sure you can generalize this to any system that segregates. There are all sorts of examples in biology and physics."

Polyisoprene and polystyrene copolymers often form interlaced networks having a tetrahedral geometry, resembling the way carbon atoms each link to four neighbors in a diamond structure. Thomas and his group have shown these structures also have analogous minimal surfaces.



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Two-dimensional projection of Scherk's surface (far left) produces pattern (near left) resembling electron micrograph of a polymer interface (above).

Such a diamond-like geometry strongly influences the copolymer's physical properties. Whereas polystyrene by itself is stiff and brittle while polyisoprene is rubbery, the combination ends up with the stiffness of one component and the toughness of the other. Such synergistic combinations may be useful in the production of superior composite materials.

In a phase transition, a material changes from one form into another, which sometimes has a different symmetry or arrangement. Thomas would like to know the possible pathways a material could follow to make that transition. Mathematically, the problem is one of studying the transformation of one minimal surface into another. "Can I take a particular structure, deform it to produce another structure and do it smoothly in an efficient manner?" Thomas asks. "That's a new question for mathematicians." *– I. Peterson*