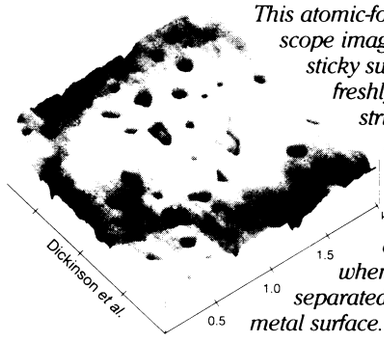
In the peel zone: Tape's electric gooeyness

Peeling a strip of adhesive tape off a smooth surface is a violent process. As the adhesive stretches into strands, or fibrils, that suddenly snap apart, electrical activity is generated at the tape-surface juncture, often accompanied by a flickering glow visible in a darkened room.

Now, J. Thomas Dickinson and his coworkers at Washington State University in Pullman have investigated the microscopic details of what happens when someone strips a common type of household adhesive tape from a polished copper surface.

The researchers discovered that the electrical current generated by the peeling tape fluctuates erratically. Moreover, the tape's initially smooth but sticky surface ends up pitted with cavities having a wide range of sizes.

"The dance of fibril detachment occurring across the entire width of the tape is a chaotic process," Dickinson suggests.



This atomic-force microscope image of the sticky surface of a freshly peeled strip of adhesive tape reveals tiny cavities created when the tape separated from a metal surface.

"Thus, the forces acting on the adhesive... result in rich void and fibril formation... that greatly influences the way tape peels."

The researchers report their findings in the November JOURNAL OF ADHESION SCIENCE AND TECHNOLOGY.

When adhesive tape comes into contact with a surface, electrons shift from one material to the other to give them opposite electrical charges. The attraction between these oppositely charged surfaces contributes to the adhesive bond.

Peeling stresses the adhesive, creating little cavities in the material. As the process continues, the walls of the cavities stretch into fibrils. At the same time, measurable electrical discharges occur between the electrically charged tape and the metal surface near these cavities. Measurements of the resulting electrical currents reveal details of the peeling process on time scales down to nanoseconds.

"The more fibril formation and stretching that you get, the stickier the adhesive is," Dickinson says. Hence, a large proportion of the energy required to peel a strongly adhering tape goes into stretching the fibrils and working the gooey adhesive.

This research represents an extension of an earlier effort to study cracking and fracture in brittle materials (SN: 5/4/91, p.279). Fractures may also generate electricity and light. *— I. Peterson*

Stress gives rise to NGF

The body's neurons, or nerve cells, do a lot. Not only are they involved in processing information in the brain, they also receive and transmit signals from sensory organs and other neurons and may play a role in triggering the body's immune system.

Now, a new study shows that the body's concentration of nerve growth factor (NGF), a protein that helps neurons survive, increases under stress. The corresponding increase of NGF receptors in the lymphocytes, a population of white blood cells that helps fight disease, may show a link between the brain and the immune system, says Luigi Aloe of the Institute of Neurobiology in Rome, who led the team.

Using parachute jumping as a model of stress, the researchers measured the concentrations of NGF and NGF receptors in 20- to 24-year-old Italian soldiers.

"The thrill of the novice experiencing his first parachute jump proved to be a good measure of stress and anxiety," explains Aloe, whose team reported its findings in the Oct. 25 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

After dividing the participants into two groups — those who would jump and those who would not — the researchers told each group its status and collected blood samples from each soldier.

The evening before the jump, those who knew they would parachute showed an 84 percent increase in NGF over those not jumping. After landing, the parachutists' NGF was 107 percent higher than that of the other group. Both blood samplings showed an increase in NGF receptors.

The researchers also examined what effect the stress hormones ACTH and cortisol might have played in this increase. Hormone concentrations remained stable before the jump, the researchers found, rising only after the soldiers had parachuted.

"The study clearly shows that NGF is a marker for stress in the human body and that the body acts a whole," says Vassilis Koliatsos of Johns Hopkins University School of Medicine in Baltimore. *— A.C. Brooks*

Hormone shows link to some obsessions

Excess amounts of a brain hormone involved in grooming and social behavior may play a role in one type of obsessive-compulsive disorder (OCD), a new study suggests.

Concentrations of the hormone oxytocin in the brain apparently rise only in OCD sufferers who have no personal or family history of Tourette's syndrome or related tic disorders, assert James F. Leckman, a psychiatrist at the Yale University School of Medicine, and his colleagues.

In contrast, they theorize that a link exists between another form of OCD and such tic disorders, which involve impulsive behaviors and compulsively repeated movements or vocalizations (SN: 7/21/90, p.42).

"If confirmed, these findings open a new chapter in our understanding of the neurobiological [process] that underlies some forms of OCD," Leckman's team concludes in the October ARCHIVES OF GENERAL PSYCHIATRY.

OCD consists of repeated, upsetting thoughts or images linked to acts that a person feels compelled to carry out. For instance, this condition may spark fears of germ contamination that lead to hours of hand washing every day, even to the point of rubbing off skin and disrupting all other activities.

Leckman and his coworkers collected cerebrospinal fluid from 29 individuals diagnosed with OCD, 23 people with Tourette's syndrome, and 31 people free of psychiatric disorders. Participants ranged in age from 13 to 60.

The scientists measured oxytocin and vasopressin, a brain hormone also involved in grooming and social behavior that was implicated in OCD in an earlier study by researchers at the National Institute of Mental Health in Bethesda, Md. In the new project, volunteers and their parents, siblings, and spouses provided information on any cases of OCD, Tourette's syndrome, or related conditions among family members.

All three groups displayed comparable vasopressin concentrations, but oxytocin rose dramatically in the 22 OCD sufferers who had no personal or family history of tic disorders, the researchers found. In this set of volunteers, those showing the most severe OCD symptoms had the highest oxytocin concentrations.

Preliminary data gathered by the same investigators also suggest that tic-related OCD most often involves compulsions to touch certain objects over and over, while non-tic-related OCD more frequently includes contamination worries and cleaning compulsions. *— B. Bower*