

set of initial conditions, or basin of attraction, leading to one attractor is riddled with points corresponding to initial conditions leading to another outcome. In other words, the two basins are completely intermingled (SN: 11/14/92, p.329).

Soon after, John C. Sommerer of the Johns Hopkins University Applied Physics Laboratory in Laurel, Md., and Edward Ott of the University of Maryland discovered similar behavior in a differential equation representing the motion of a particle traversing a force field having a particular geometry (SN: 9/18/93, p.180). They also suggested that behavior indicative of riddled basins could occur in oscillator circuits that generate chaotic signals. It's possible to link these circuits to synchronize their chaotic behavior (SN: 10/12/91, p.239).

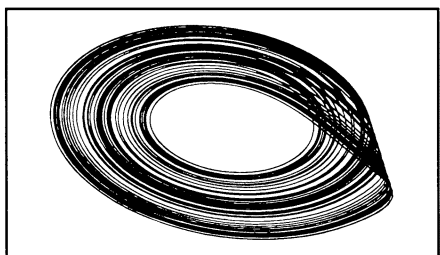
Recently, Peter Ashwin, Jorge Buescu, and Ian Stewart of the Mathematics Institute at the University of Warwick in Coventry, England, investigated the behavior of an identical pair of such circuits. By weakening the link between the two circuits, they showed how the system's behavior gradually changes from a totally synchronous state to one in which the oscillators operate independently, passing through a stage in which the system switches unpredictably in and out of synchrony.

"We studied the details of this loss of synchrony and showed that it is entirely consistent with the riddled-basin scenario," Stewart says.

James F. Heagy, Thomas L. Carroll, and Louis M. Pecora of the Naval Research Laboratory in Washington, D.C., used a system consisting of four linked oscillator circuits. They concentrated on the details of the system's behavior when the connection between the circuits was weak enough to allow both synchronous and nonsynchronous behavior.

"Our work has shown that riddled basins indeed exist in real physical systems . . . and must be taken into account for a proper understanding of the system," the researchers say. They report their findings in the Dec. 26, 1994 PHYSICAL REVIEW LETTERS.

Now, researchers are searching for traces of riddled basins in other settings. But the documented evidence is skimpy. These are not the kinds of results normally reported in journals. — I. Peterson



Chaotic attractor representing voltage fluctuations of an oscillator circuit.

Heagy, Carroll, Pecora

Grief sometimes heads down a grievous path

When loved ones die, they leave behind a legacy of emotional pain. Many clinicians and researchers view depression as the most worrisome psychological fallout of bereavement, because the sense of personal worthlessness and despair typical of that condition can lead to suicide.

But bereavement may also trigger a unique and previously unrecognized disorder that disrupts lives for at least 2 years afterward, a new study suggests. Known as complicated grief, this persistent yearning for a deceased person and other, related symptoms often occurs without signs of depression.

"The symptoms of complicated grief, while appearing to be normal reactions to the loss of a loved one, nevertheless were significantly associated with later impairments in global [psychological] functioning, mood, sleep, and self-esteem," psychologist Holly G. Prigerson of the University of Pittsburgh School of Medicine and her coworkers assert.

The findings support Sigmund Freud's contention in a 1917 monograph that depression touched off by a loved one's death drags down self-esteem, whereas grief (or what Freud called mourning) does not. However, Freud, the founder of psychoanalysis, viewed grief as a uniformly healthy process, while Prigerson's group argues that it can sometimes take a virulent form.

The researchers administered questionnaires to 82 men and women, age 60 to 85, 3 to 6 months after the death of their spouses. The team collected follow-up data from 50 participants 18 months later.

Analysis of initial responses revealed two distinct clusters of symptoms that in some cases overlap, the scientists report in the January AMERICAN JOURNAL OF PSYCHIATRY. Bereavement-related depression includes apathy, insomnia, extreme sadness, low self-esteem, and thoughts of suicide. In contrast, complicated grief consists of searching and yearning for the deceased, crying, feeling stunned by the death, not believing that the loss occurred, and being preoccupied with thoughts of the loved one.

Fourteen of the volunteers who completed the follow-up had begun the study with moderate to severe depression. Of 13 participants who cited substantial problems with complicated grief, only 7 also reported marked depression.

While those suffering from complicated grief displayed several psychological and sleep difficulties at the follow-up, volunteers with bereavement-related depression reported an increase in medical illnesses.

If further research confirms these results, it may be necessary to develop

specific treatments for complicated grief, the researchers contend.

"Depression requires a psychotherapeutic and psychopharmacological approach, whereas grief lends itself to the support of a responsive ear," writes Milton Viederman, a psychiatrist at Cornell University Medical College in New York City, in an accompanying comment.

Current diagnostic guidelines for psychiatric disorders emphasize treating depression linked to bereavement but not symptoms of intense grief.

Earlier research, which did not measure complicated grief, found that frequent thoughts of a deceased spouse or child, as well as depression and failure to resolve the loss, often endure for as long as 7 years (SN: 2/7/87, p.84).

Conversely, some people encounter no grief after a loved one's death and may experience beneficial changes in their view of the world, Viederman asserts. The lingering or sudden nature of a death, its finality or ambiguity (as in cases of soldiers missing in action), the way in which death occurred, and the psychological relationship of a survivor to the deceased all influence the expression of grief, he notes. — B. Bower

HIV's infectious nature

People infected with HIV are far more infectious during the first 2 months after contracting the AIDS-causing virus than previously suspected, a new study shows.

James S. Koopman of the University of Michigan in Ann Arbor and his colleagues collected epidemiological data from a number of studies, including one that looked at more than 8,000 homosexual men in San Francisco and Chicago and one that included 1,115 military personnel in Thailand. Using a computer simulation, the researchers examined how certain variables affect the spread of HIV. Only when the scientists assumed a very high degree of infectiousness during the first 2 months did the computer model match the real-life epidemic.

The data suggest that rates of HIV infection during that early period may be 100 to 1,000 times higher than in the long asymptomatic phase that follows. Koopman and his colleagues initially detailed their study in the November JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES.

The findings suggest that vaccine researchers should focus on blocking that early, infectious stage. If one could devise such a vaccine, it might effectively slow the epidemic, Koopman notes. — K. A. Fackelmann