

Walls With Voices

Do you see the ugly concrete wall in the picture below? Artist Eric Grohe doesn't. Instead, he sees an opportunity to archive a community's collective memory. To see the wall as Grohe sees it, [click here](#).



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Coming to Terms

There's a lot of vernacular surrounding complexity science. Every now and then we need to stop, look at the terms, and ask ourselves: *so what does this mean, anyway?* This new feature begins with a look at the term *chaos*.

**new
feature!**

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Complexity & Nursing: A New Lens

How can our understanding of complex adaptive systems be used to promote health and healing? Don't miss our Plexus conference designed for health care practitioners on May 31! Find out more [here](#).

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plus

Book Review: Robustness and Evolvability
Meet Our Members • Plexus Fractals • PlexusCalls

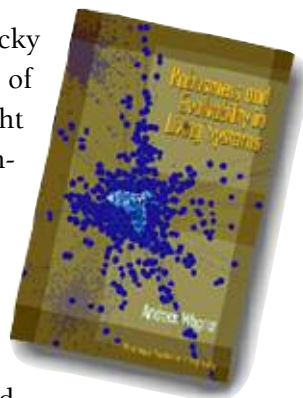
How Organisms Persist

DNA is unstable, and full of mutation. So how do living organisms thrive, instead of growing two heads? A new book takes a scholarly look at the paradox.

Human beings and other animals are usually lucky enough not to be born with the wrong number of heads and limbs. In fact, even living things that might seem fragile have survived billions of years of environmental assaults and internal mutations.

In *Robustness and Evolvability in Living Systems*, Andreas Wagner provides a penetrating exploration of how organisms continue to thrive in spite of external and internal adversities. Wagner is an Associate Professor of Biology at the University of New Mexico and an external faculty member of the Santa Fe Institute for the Study of Complex Systems. He brings his knowledge of computational and theoretical evolutionary biology to his analysis of robustness at all levels of biological organization, from DNA through protein structures, through genetic networks and embryonic development, to the whole organism. A biological system is robust, he explains, if it continues to function in the face of mutations caused by genetic change or non-genetic disturbances such as variations in the environment.

He shows how natural selection favors the most robust solutions to problems that organisms face, solutions that allow them to survive and reproduce. Robustness may be an intrinsic property of biological systems, he theorizes, because of redundancy and “distributed robustness.” Redundancy, he says, is easy to understand: It means having many spare parts, something akin to keeping extra light bulbs in the house. Distributed robustness is far more difficult. It involves the capacity a whole system to absorb many internal and external assaults in a variety of ways through multiple networked mechanisms and processes.



For instance, Wagner writes, the fruit fly has a network of regulatory genes responsible for dividing the embryo into segments. Physicists know the job could be done simply and efficiently with two regulatory molecules. But the fruit fly uses more than a dozen genes that regulate each other in very complicated ways. Wagner calls that a Byzantine and inelegant way for the segmentation gene network to be built, and he suggests that may be what is necessary “to ensure consistent embryogenesis in the face of variations in temperature, embryo size, concentrations of regulatory molecules, and perhaps even mutations.”

And if that hypothesis is true, he continues, and engineered systems need similar architecture to function in the face of unpredictable elements, then robustness in living and nonliving systems may have much in common. It is perhaps no coincidence, he writes, “that a modern commercial aircraft consist of more than 100,000 different subsystems and employ more than 1,000 central processing units that automate the aircraft’s operation.”

Wagner cites the telephone network as another example of distributed robustness in a nonliving system. Its most basic functions are to generate a dial tone, switch an incoming call to the right party, and disconnect it when it is finished, he writes, and doing that for hundreds of millions of customers world-wide requires sophisticated technology and a massive network involving many hundreds of thousands of lines of computer code. How is the system so reliable? Most failures are local, and telephone switches can reroute traffic dynamically so that a small failure has little impact on the whole system. Robustness in nonliving systems, he asserts, has its origins in self-organization. Wagner devotes a whole chapter to that self organization, although he observes the subject it is so vast it would be hard to do it justice even in a whole book.

One of Wagner’s most provocative ideas is the concept of “neutral space.” He doesn’t use the term in a conversational way suggesting disengagement or indifference. He observes that there are always many different ways to achieve the same result, and he suggests that a whole collection of equally workable solutions occupy what he calls a neutral space.

Engineers and biologists will find fascinating information and ideas in this book. It’s not casual reading for a non-specialist. But if you sit up straight with your feet flat on the floor and take notes, you may find yourself mulling over some practical and philosophical questions that haven’t occurred to you before.

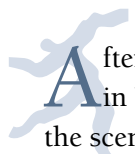


By: Prucia Buscell, Plexus Institute

“Biological systems, [Wagner] theorizes, are redundant. They have many spare parts, something akin to keeping extra light bulbs in the house.”

The Walls Have Voices

How one mural painter uses trompe l'oeil — “trick of the eye — to capture memories of the past, and reinvigorate the hearts of communities.

 After he finished a colossal mural that recreated a gentler, more elegant era in Bucyrus, Ohio, artist Eric Grohe returned and added another person to the scene. He painted in a young woman in a white summer dress, with a baby carriage, holding her head in her hand as she viewed a telegram.

The mural, *Great American Crossroads*, had transformed a blotched gray cement wall and gravel parking lot into a visually dramatic entrance to the city and a welcoming space for concerts and private and public celebrations. The scene depicted stately old buildings, demolished or burned over the years, that people in town had loved. With the final project unveiled, Grohe was signing autographs when an elderly woman approached and thanked him for putting the Western Union office in the picture. She told him she had gone to that office during World War II to get the telegram telling her that her husband was missing. She was pregnant at the time. Some days later, after giving birth to their child, she returned, pushing the baby carriage, to get the telegram saying her husband had been killed in action.

“The point was she had been so optimistic when she got that first message, so full of hope for her husband,” Grohe said, “and then she got that final notice.” Grohe was deeply moved by her story, and the woman was touched by the change he made in the picture. “That’s the kind of heartfelt story we want to build into these things,” Grohe says. “The images have to be powerful as art, not just civic reminiscence, but you want real stories about real people.” And of course the woman became one of his many life-long friends.

Art for Community Transformation

Eric Grohe’s murals are an extraordinary blend of history, investigative reporting, hard labor, soaring talent and emotional impact painted large by an

artist whose vision is nothing less than human connection and community transformation.

In Bucyrus, Ohio, a city of some 13,000 residents, Grohe and his wife, Kathy, an artist who manages the couple's business matters, got to know the past, the people, and the daily rhythm of the life. In all their work, they learn the often-overlooked details, joys, dangers, sorrows and idiosyncrasies of communities and workplaces. And that information, along with the compelling personal stories they inevitably hear, informs Grohe's artistic conceptualizations. Bucyrus was one of the country's great intersections—an old stagecoach road from the east coast to Chicago, and a north-south road linking southern Ohio with Lake Erie crossed in Bucyrus. A trolley line from Columbus to Cleveland also passed through. The Bucyrus Area Community Foundation and Bucyrus Downtown Revitalization Committee knew of Grohe's work in Steubenville, Ohio and invited him to look at a deteriorated present-day site. What Grohe envisioned was art that would change and challenge—a visually rewarding spot with an emotional appeal to nostalgia for the past and promise

for the future. Every horse, every person over the years, had used these roads to get from one big chunk of America to another, Grohe muses, and the city was, literally, a Great American Crossroads. "We interviewed everyone in sight," he remembers. "There was a group of



The wall in downtown Bucyrus, Ohio, before Grohe's transformation.



*"Great American Crossroads" -- Bucyrus, Ohio. 34' x 130', acrylic on prepared cement block
Dominating the main square of town, this once gray, soiled wall and gravel parking lot have become both a dramatic entrance to the city as well as a backdrop for numerous concerts and civic events.*

about 30 gentlemen, all retired, who had breakfast together every day. They had a club. They called themselves the Rusty Zippers. They all had strong individual opinions, and I had the privilege of talking with them all about what should go up. A consensus began to build, and I agreed with it. It fit the conditions.”

People agreed they missed some beautiful, irreplaceable old buildings that had disappeared over time. One was a hotel. “Henry Ford got off the train and stayed in that hotel along with other prominent industrialists and inventors, on their way to the funeral of President Harding,” Grohe discovered in his research. “President Harding may have stayed there himself. We learned that he was quite playful—we hear lot of things that don’t end up in history books. People wanted those buildings back, and they wanted the square the way it used it used to look at the turn of the last century. We put it back.”

Eric and Kathy Grohe studied old photographs and continued to talk to people. They found a host of historical characters to populate the visual restoration, along with local legend and reminiscences. When traffic lights were first installed, one city police captain was skeptical of their efficacy. He dutifully directed traffic for years with the light changing above him. “He was quite a character,” Grohe says. “We found many people to pose as their earlier relatives. A young Dwight Eisenhower passed through Bucyrus after his graduation from West Point, and I painted him trying to bum a dime for a phone call from a banker, a Mr. Blickey, who had been a banker in town for over 60 years. I portray the banker pulling out his pockets to show he has no change, Each of the approximately 80 people in the mural was a person with a story. As Grohe painted, passers-by would gaze at the emerging creation and remember—a father who had been a cook in the hotel, an uncle who had been a lawyer in a second floor office. Some of those recollections would become immortalized in art.

“People wanted those [old] buildings back, and they wanted the square the way it used it used to look at the turn of the last century. We put it back.”

It Starts with Stories

Eric and Kathy Grohe have enduring respect and affection for the people and places they have come to know. They want projects to capture local values, not just decorate a space. “Research is a great thrill. It’s a wonderful part of the process, and you can always find something” Grohe says of his local explorations. “I now know more about brewing beer than I ever thought I would. We had three clients that required that knowledge. We generally start by talking to the oldest person we can find who worked in the business.”

When researching a project for the American Hop Museum in Toppenish, Washington, he found people who had done the difficult work of harvesting the green cones from the vines before picking machines were used. “We found people who had gone out as a family unit and picked hops,” he says. “We listened to hours of stories. Sometimes just a little off hand comment would make a difference in a painting. We heard a story about a little competition between families, we learned the look guys had when they saw an overseer who wasn’t friendly to them, or how you could make the bag look fuller than it was when he was looking, and then go back and fill it later. You hear all the inside stuff, and something about it becomes a significant part of the image. You have to come upon the human touches, and make it connect with the viewer, emotionally, not just as an image of history. We want the work to have a real quality so you are influenced by it.”

Hops add aroma and bitterness to beer. The museum to honor the hop industry was in a rundown building built in 1917. Grohe’s artwork transformed the exterior with trompe l’oeil architectural details and murals commemorating the significance and dignity of the work.



When a rundown, 1917 building became the home of the American Hop Museum, little thought was given to its exterior.



Trompe l’oeil is a French term that literally means “trick of the eye.” It’s a style of painting that flourished in the Renaissance. Objects painted on flat surfaces look starkly three-dimensional. The depth in Grohe’s murals is



*18’ x 42’ (front); 18’ x 90’ (side); Acrylic and oils on prepared masonry
The addition of trompe l’oeil architecture, murals and text dignified the facade and provided a visual history of the local Hop industry.*

stunning. A viewer has an immediate sense of entering some scenes, and is convinced of structural solidity in columns and bridges in others. Grohe observes that all those techniques are explained in art textbooks, though he adds that he has done enough sculpture himself to appreciate sculptural achievements.

It's hard to imagine that *The Liberty Remembered* mural in Bucyrus, Ohio, is actually a flat wall. It shows Lady Liberty holding a dying soldier in her arms. The faces of 284 local veterans were painted to look as though they were carved in stone columns and on the wall behind the figure. The Grohes put an ad in the local paper seeking photographs of veterans from Crawford County, Ohio. "We also asked for pictures of people, living or dead, who have served in any of the services. There was a guy in town who had fought with George Washington," Grohe says, "and when he turned 103 someone took his picture. So he is there, and his relatives can recognize him, right next to a soldier from Desert Storm."



"Liberty Remembers"; 36' x 44' Keim Mineral Paint & Universal Render on concrete block. An old brick wall was reinforced with concrete block and transformed into a nationally recognized monument honoring veterans. In this mural, Lady Liberty cradles a dying soldier in her arms, surrounded by the portraits of 284 veterans from Crawford County, Ohio.

Halfway through the painting, a car pulled up and an elderly woman stepped out, recognized the face of her husband and burst into tears. The scene was repeated several times as passers-by recognized loved ones. “One day a father came whose son had just committed suicide because of the terrible problems he had with Gulf War Syndrome,” Grohe says. “I had just painted his face 10 days before.” The father stood before the mural, overwhelmed. Grohe recalls the encounter as emotional, and meaningful.

Another fulfilling project for the Grohes was creation of murals at the Washington State Correction Center for Women in Gig Harbor, Washington. Grohe met with administrators, guards and prisoners. One prisoner confided that the women who will be incarcerated forever need something comforting, and those who will be released need encouragement—a reminder that “there is a world out there.” The four murals in *Paths of Promise* are painted on panels and blend into the existing architecture of the prison courtyard, and are visible from the inmates’ daily route to and from the cafeteria. Grohe created beautiful images with no fences or barriers—a natural scene over a bridge, a cityscape with a waiting family, an archway that invites a gentle imaginary journey. After the work was fully installed, there was a presentation in the outdoor plaza, where a podium, loudspeakers and more than 100 seats were set up. Four inmates told how the “spirit-filled beauty” of the art inspired and heartened them. “There was not a dry eye in the audience,” Grohe says.



Details from one of the four murals in “*Paths of Promise*,” Washington State Corrections Center for Women • Four murals, 9’ x 15’ ea., acrylic on dibond®

A women’s prison is by nature confining and restrictive. The imagery in these four murals was created not only to provide a visual and mental escape, but to inspire as well. The murals were designed to fit within the existing architecture of the prison courtyard.

Steubenville, Ohio, was a steel town since its beginnings. Before painting his Tribute to the Steel Industry, Grohe took training in steel mills to get a sense of the daily routine. “If you stepped forward you’d get burned. If you stepped backwards you’d be electrocuted, if you stepped to the side you’d be crushed,” he says. “You have to communicate those conditions. We heard heartbreaking stories of families being destroyed by some aspect of it or another. We heard amazing stories of kids struggling with studies until 3 and 4 in the morning so they could try to get out. And sometimes they did, and they came back as owners, not laborers.”

Today people are more mobile, he observes. But back in the 20s and 30s, there was company housing, people lived in narrow little streets, and neither they nor their kids had much hope of leaving. “Years ago, you were a miner or a steel guy. That was it. It was a done deal.”

The Hard Work of Transformation

The murals are hard physical work. After the design is complete, Grohe says, it’s a race against the weather. He works seven days a week, from dawn to dark. Depending on the physical circumstances, it may be possible to protect a wall against direct rainfall, but the paint is sensitive to moisture content so the wall cannot be overly damp. While he has worked in blazing heat, Grohe says, “the surface, the air, the paint and myself have to be above 40 degrees” Fahrenheit. He employs skilled aides for some of the non-creative, but technically demanding work. While Grohe’s website www.ericgrohemurals.com reflects modern technological savvy, and a great opportunity to view his work, some of his materials were developed more than a century ago, and some of his techniques have been used by artists for thousands of years.

Grohe uses Keim mineral paint, which was developed 127 years ago. When Mad King Ludwig 11 of Austria was building his Neuschwanstein Castle in the late 1800s he was concerned about the quality of the paint on the turrets, which were hard for painters to climb. He contacted the scientist A.W. Keim, who combined a “liquid glass” with inorganic color pigments that permeate and chemically react with the surfaces to which they are applied. “All the pigments we use come from the ground. Iron oxide, for instance, has gone through chemical processes for millions of years. So these paints produce beautiful, vibrant colors that stay that way,” Grohe explains. “The other pigments you get off the shelf commercially are all synthetic, with molecules built last week. They are subject to change. In the presence of oxygen and ultraviolet light they break down, and sometimes shift from one color to another, and sometimes they just fade.”

“Halfway through the painting, a car pulled up and an elderly woman stepped out, recognized the face of her husband in the mural and burst into tears.”

How do you transfer an image from a conceptual drawing to the scale needed for a 50 foot high wall? The same way Michelangelo did on the ceiling of the Sistine Chapel. You put the large image on paper, use a ponce wheel, similar to one used in sewing, to make holes in the paper, then hit the paper with a sock full of powdered chalk. The chalk goes through the holes and leaves a tracing of the image on the wall. He uses a snap line, or a chalk coated cord on a wheel with a side crank to produce a horizontal line. A few hundred years ago mural painters used a string wound around a twig, Grohe comments, and there is still no better way.

On big mural projects, says Grohe, the artwork is the “tip of the proverbial iceberg”. The drama is in the planning, the committee meetings, the political arguing and the replay of local antipathies that have intensified for decades that have little or nothing to do with art. “Sometimes we are like bartenders at large,” Grohe remarks. Sometimes they mediate, sometimes avoid the fray.

“We live in the communities where we work,” Grohe adds. “We invest a year of our lives. It’s all very personal to us. You always connect with people on these projects. I don’t think there is a single project we’ve done where there weren’t stories connected to the research or the imagery. These are truly stories of life, death, and heroic circumstances.”

Painting in public, at ground level or on a lift, for six months at a stretch invites people to talk. “We hear every story,” Grohe says. “Sometimes people tell you things they wouldn’t tell their psychiatrists.”

But the Grohes take personal foibles in stride, keep confidences, and retain fond memories. Grohe says he’s always asked his favorite mural, and his answer is always “the next one”. Any work in progress, he says, ought to tap past experience to be the best, most emotional, most challenging or most transforming. Working on projects that mean something to a community has huge rewards, Grohe says, and when they are finished, it’s always a long goodbye.

The Grohes are now off to the Cempacka International School in Malaysia where Grohe has been invited to teach students from several countries the aesthetics and mechanics of painting murals. ■

By: Prucia Buscell, Plexus Institute

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emerging: defining the terms

What is “Chaos”?

To the ancient Greeks, **chaos** was a gaping void, a vast and dark primeval nothingness, from which the gods and all living things emerged. Some scholars say, however, that chaos wasn't really a void, but an underlying mass of something randomly assembled. And still others believe chaos was born of mist, which came first.

In today's popular parlance, chaos still implies uncertainty and opacity—unfathomable disorder, the incomprehensible savagery and destruction of the battlefield, and the inexplicable dislocation and confusion that follows social breakdown and natural disaster.

To scientists and mathematicians, chaos is all around us, in systems as diverse as the weather, the oceans, human physiology, the workings of human hearts and brains, the rise and fall of insect populations, and fluctuations of the stock market. But scientists don't use the term as it is used in ordinary conversation. To scientists, chaos is the polar opposite of randomness. Chaotic patterns are often obscured by the sheer size of their systems, but the patterns are there. Chaos is a nonlinear dynamic system in which things that seem random are actually highly ordered and can be predicted from simple deterministic equations. That means, in math, that the next value of data can be calculated from the previous values of the data.

What is this new feature?

Defining the Terms is a new feature on the language of complexity that begins in this issue with an exploration of what scholars and theoreticians have written about *chaos*. This new feature is intended for those new to the subject, and those who want to deepen their knowledge.

A term or expression that appears frequently in complexity science literature will be explored in each issue. If there is a term or phrase that particularly interests you, let us know. If there is an expression you have special insights about, please write them for us. If there is a term you think is puzzling, or often misused or misunderstood, please tell us about that too. Your own observations are welcome, as are your questions and comments.

As Larry Liebovitch explains in his book *Fractals and Chaos Simplified for the Life Sciences*, “chaos means that the output of a deterministic system is so complex that it mimics the output generated by a random mechanism.”

Learn More about “Chaos”

Some brilliant scholars with a gift for lucid explanation have produced a wide assortment of books, articles, web sites, and tutorials to introduce the concepts of chaos to new learners and elaborate on their intricacies for advanced learners and the mathematically sophisticated. James Gleick’s book “Chaos: Making a New Science” is one of the most engaging works, and it is highly accessible to non-mathematicians.

If you are just beginning your exploration of chaos and complexity, Dr. Matthew A. Trump of the [Ilya Prigogine Center for Statistical Mechanics and Complexity Science](#) offers a [web site](#) titled *What is Chaos: a five part online course for everyone*. It’s clear, entertaining, and it creatively organizes difficult concepts in simple terms. Another valuable resource, with material that ranges from introductory to advanced, is the [tutorials at the Society for Chaos Theory in the Psychology and Life Sciences web site](#). *Chaos and Complexity Resources for Students and Teachers* takes the visitor on a guided tour that begins with basics and entices the visitor to explore in greater depth. The stated purpose is to

“provide you with concise descriptions of the concepts underlying Nonlinear Dynamical Systems.” Three tutorials prepared by Dr. Liebovitch are available on the website. Dr. Liebovitch is a physicist and astronomer who is interim director of the Center for Complex Systems and Brain Sciences at Florida Atlantic University. One of his tutorials is an [Introduction to Chaos](#), one is an [Introduction to Fractals](#), and another is titled [More about Fractals and Scaling](#). Dr. Liebovitch’s tutorials can help beginners learn complexity concepts, as well as deepen the understanding of advanced students. He presents difficult material in digestible bites, accompanied by creative illustrations and forthright language. His sequential PowerPoints range from accessible to formidable.

The [Chaos Group at the University of Maryland](#) has been researching various areas of chaotic dynamics for more than three decades and has a web site that invites a range of explorations. Professor James Yorke, who holds appointments in both mathematics and physics, coined the use of the term chaos for the mathematical study of nonlinear dynamic systems. He is a leading scholar in the field, and has played a major role in further development of research into chaos and its applications.

If you would like to review a concise definition of chaos, and familiarize yourself with some of the many other terms you may find in your reading and

“Is chaos unfathomable randomness or is it a highly ordered system that can be described mathematically?”

surfing, the [glossary prepared by Jeffrey Goldstein for *Edgware: Insights from Complexity Science for Health Care Leaders*](#) is an excellent resource. Edgware was written by complexity experts Brenda Zimmerman, Curt Lindberg and Paul Plsek. Curt Lindberg is President of Plexus Institute. Dr. Liebovitch and Dr. Goldstein are Plexus Institute Science Advisors. ■

By: Prucia Buscell, Plexus Institute

Meet Our Members

In keeping with our newly designed membership offerings, our “new member” feature in emerging is being modified. This feature will now honor *all* Plexus Associates — those who have just joined as well as those who have been with Plexus in the past. If you are a member – new or established – who has interests and projects you would like to share with others in the Plexus community, let us know!

Art Ulene

“What am I doing at the moment?” I am having the time of my life! I “retired” two years ago, when my wife helped me to recognize that I was on “autopilot” — working just as hard as ever, but not getting the same joy from my efforts. Since then (except for an occasional speech or consulting job), I have tried to limit my involvement to things that bring me joy and have potential value to others. The most meaningful things in my life: Priscilla, my wife of 45 years; my “kids” (now 42, 40 and 39); my five grandchildren; travel (Priscilla and I have already visited 59 countries and will reach 62 by the end of the year); my photography and art (I take art classes with my nine-year-old granddaughter); and “payback” (raising money for cancer research and scholarships for indigenous children in Guatemala; acting as Legal Guardian for a troubled child).



I am working diligently (and successfully) to enrich my life by simplifying it. (Oops, what does that say about complexity?) A smaller home, older cars, tired clothes and fewer things mean more time to read, to watch children play and hummingbirds feed. Yesterday morning, I spent ten minutes watching a butterfly in motion, and wondering: *what do butterflies eat to sustain their activ-*

ity? For the first time in my life, I don't have to have an immediate answer to my questions (but I would welcome the answer from anyone who is reading this).

“What interests me most about complexity?” I am intrigued by the different ways people react to complexity. Many are frightened by it—so frightened, they will accept any explanation that can make them feel more comfortable with it. At the other end of the spectrum, are those who are curious about it—so curious, they actually study complexity, and discover that things are, perhaps, not as complex as they appear. I'm a “complexity agnostic” — an interested observer, hoping I live long enough to learn who is right.

“How did I learn about Plexus Institute?” For many years, I've heard Grey Warner talk about the the Institute and how much he has gained from his association with it. Grey and his wife (and his company, Merck) have been strong supporters of the Guatemalan programs with which we are affiliated, so when he suggested that I attend a Plexus-sponsored seminar on Positive Deviance, I jumped at the chance. Once exposed to the workings of the Institute (and to the fascinating complexity of complexity), I had to become a member myself.

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Donna Sullivan Havens, PhD, RN, FAAN

Donna Sullivan Havens is Professor and Division Chair in the School of Nursing at the University of North Carolina at Chapel Hill. Dr. Havens also holds appointments as an adjunct professor in the School of Nursing at the Pennsylvania State University where once she served as the Elouise Ross Eberly Endowed Chair and Professor of Research. She earned a diploma from the Grace New Haven School of Nursing at the Yale Medical Center in New Haven, CT; a BS in Nursing from Cedar Crest College in Allentown, PA; an MSN from Villanova University; and a PhD in Nursing from the University of Maryland. She completed a post-doctoral fellowship in the Center for Health Outcomes and Policy Research at the University of Pennsylvania to conduct research on the organization of nursing and outcomes.



For more than 18 years, Donna has studied and published widely about the nursing practice environment and has focused on professional nursing practice, staff nurse empowerment and nurse decisional involvement. She has conducted numerous studies about the nursing work environment, magnet hospitals and patient and staff outcomes. In her former role as Assistant Director of Nursing and Director of the Center for Patient Services Outcomes Evaluation & Research at Penn State's academic health center in Hershey PA, she directed hospital-wide patient outcome initiatives, launched the ANCC magnet application process, and implemented the ANA “Nursing Quality Indicator/Report

Card Program” (NDNQI). She is currently funded by HRSA to translate what we have learned from research about the nursing work environment and outcomes into evidence-based leadership and management to improve nursing practice and the quality of patient care.

Complexity Science is serving as a guide to this exciting work in a five-year project to enhance staff nurse decisional involvement, communication/ collaboration between nurses and nurses and nurses and other providers, and cultural awareness and sensitivity in six community hospitals in PA. Project strategies include: data collection, feedback, and comparisons; appreciative inquiry; networking; learning collaboratives; and mentoring by magnet hospitals.

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Jon C. Lloyd, M.D.

Dr Lloyd received his Medical Degree from the University of Utah School of Medicine in 1968. From 1968 to 1976, Dr. Lloyd completed his training in general, thoracic and vascular surgery at the University of Pittsburgh Medical Center, served as Director of the Surgical Residency Program and Director of the University Service which was the only trauma center in Pittsburgh at the time. His training was interrupted by a tour as surgeon and Major, U.S. Army at the Third Field Army Hospital in Saigon, Vietnam. He served as Chairman, Department of Surgery, Shadyside Hospital from 1978-1988.



In 1997, Dr. Lloyd participated in the founding of the Pittsburgh Regional Healthcare Initiative (PRHI) with former Alcoa C.E.O. and United States Treasury Secretary, Paul O'Neill and Karen Wolk Feinstein, PhD, Director of the Jewish Healthcare Foundation. He completed Intermountain Health Care's Advanced Training Program under the tutelage of Brent James, M.D. in 1999. Dr Lloyd practiced fulltime at UPMC-Shadyside Hospital until 2002, when he became Medical Advisor to PRHI.

In July 2004, Dr. Lloyd became Pittsburgh Project Coordinator for the Centers for Disease Control and Prevention (CDC) and the Veterans Administration Pittsburgh Healthcare System to work on a community-wide effort to eliminate endemic Methicillin resistant staphylococcus aureus (MRSA). The MRSA prevention model that emerged out of this collaborative effort in Southwestern Pennsylvania has inspired and informed a statewide MRSA prevention initiative sponsored by the state's Patient Safety Forum and supported by the Hospital Association of Pennsylvania and the Governor's Office of Health Care Reform.

Related Publications and Grant:

- Health Affairs 2003 22:157-165, "PRHI: A Systems Approach to Perfecting Patient Care." (Co-Author)

- Your Role in Preventing Hospital Acquired Infections (MRSA Orientation Module for Medical Students and Surgical Residents used at the VA Pittsburgh Healthcare System, 2004, Co-Author)
- PRHI: Executive Summary on Patient Safety, July 2004
- Plexus Institute Newsletter, May 26, 2005, Interview: “Bacteria that Resist Antibiotics.”
- Robert Wood Johnson Foundation, Grant ID No. 55726, “Reducing MRSA Infections in Hospitals Using the Positive Deviance Approach to Organizational Change,” 2006-2007.

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Nancy Hakel-Smith, PhD, RD

I am the manager of Clinical Nutrition Services at BryanLGH Medical Center in Lincoln, NE. I have been a clinical registered dietitian for almost 30 years and recently received my Ph.D. in Nutrition from the University of Nebraska, Lincoln.

As founding Clinical Nutrition Manager of the Advanced Clinical Nutrition Practice system at BryanLGH Medical Center I have successfully implemented a professional practice model that advances clinical nutrition practice. This model uses clinical problem solving and standardized languages to promote the clinical nutrition practitioner (clinical dietitian) to other disciplines and to patients and families.

I have presented nationally and internationally on the topics of the nutrition care process and nutrition diagnosis and have published and done research in this area. I have also planned and coordinated several national conferences at BryanLGH Medical Center on the topic of advancing nutrition practice. My passion is to put the advanced clinical nutrition practitioner at the forefront of changes occurring within the 21st century health care systems.

Most recently, I have become an enthusiastic student of Complexity Science. My friend, colleague, and mentor, Dr. Michael Bleich introduced me to the concept last year. Dr. Bleich also introduced me to systems thinking over a decade ago. Complexity science seems like the next logical step to thinking about approaching my roles as leader, manager, and educator.

As my knowledge and understanding of this new science develops my goals are to continue to create an environment that will unleash and coordinate the potential capabilities of clinical nutrition practitioners, facilitate clinical nutrition practitioners’ professional development, build relationships (within our own department, other departments, and with patients), and foster professional clinical nutrition practices that can lead to improved organizational and clinical outcomes.

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Trish Silber

I am an organizational consultant focused on leadership, team, and organization development. I have 20 years of experience working with organizations facing rapid changes in technology, markets, strategy, and leadership. I spend most of my time leading strategic alignment and system-wide change efforts and coaching executives (groups and individuals). Organizations also frequently contact me to facilitate groups facing high-risk and contentious situations, particularly when multiple stakeholders are involved, such as competing business units or community groups.



The more I learn about complexity, the more it informs every aspect of my client work. For example, I am guided by complexity principles whenever I design strategic planning efforts. I am lucky to be participating in a learning group with two other colleagues in which we have been exploring new ways of applying complexity to our work. We are currently trying to push the envelope on how we apply complexity to strategic planning. Recently we wrote a chapter about applying complexity principles to group facilitation for the International Association of Facilitators Handbook of Group Facilitation.

I became a member of Plexus for two reasons. The first is that I appreciate, and use, the many great resources that Plexus provides members. Second, I am impressed with the work that Plexus is pursuing, and I hope that through my membership I'll have the opportunity to support and learn from these important efforts.

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Plexus Fractals

Looking for the ultimate experience of complexity in action? Find a Plexus Fractal near you... and see what connections emerge!

Carolinas Fractal

The new Carolinas Fractal began March 3, 2006, in a session hosted by John Kello, PhD. Department of Psychology, Davidson College, Davidson, NC. The gathering included: John Kello, PhD, Davidson College; Russ Marion, PhD, Clemson University; Michael (Mickey) Patrick, VHA; Susan Pinsker, PhD, Working Solutions; Michael Arena, PhD, Bank of America; Bruce Mack; Warren Riffle

We introduced ourselves to each other, providing a brief background of education and work-related experiences. We each stated our interests in leadership and complexity; and what was significant to the invitation that summoned us to this meeting. Several in attendance have published in the areas of leadership and complexity science. Several are practitioners in leadership and leader training and development, organizational development, and organizational behavior. Other areas of practice included: executive and manager coaching; human resources development; and organization talent management.

We engaged in an abridged affinity exercise to support a discussion of leader and leadership in a context defined by complexity. Our discussion included exploration of these ideas:

- Our current understanding of leader and leadership is inadequate to serve our rapidly changing business environment.
- Our language may be a significant restraint to our learning and communicating of leader and leadership concepts and practices in light of a complexity context.
- Is “leadership” a characteristic of the person... or is it the relating that takes place between agents (the space between)?
- Our current concepts and understanding of diversity may restrain our thinking regarding leader and leadership.

We realized we really had more to discuss than our scheduled time permitted. We seemed to approach a comfort with one another only to have adjournment staring us in the face. We agreed to meet again in the next quarter of 2006. The consensus was to meet sometime during early June, 2006; and Friday was identified as the most suitable day of the week. We also agreed to look into our individual networks to identify other folks who have interests in our conversations, to invite them to attend, join in the shaping of our fractal network. (A brief note was made early-on in our meeting that we customarily mis-use the term fractal. Fractal is not a noun, rather fractal is an adjective. This awareness has us scratching our noggins regarding a name for our conversation group.)

Our meeting adjourned following the Plexus Institute Friday Conference Call on complexity and management with Henri Lipmanowicz and Grey Warner. The conference call was a nice touch (coincidental or Providence) to our tender beginnings.

The next meeting will be held June 6, with location to be announced.

For further information, contact: W. Warren Riffle

E-mail: wwriffle@alltel.net

DC Fractal

The spring meeting of the Washington, DC fractal featured a preview of the PBS documentary Good News: How Hospitals Heal Themselves, produced by journalist and author Clare Crawford-Mason. Upcoming schedule will be announced.

For information, contact Lisa Kimball at Lisa@GroupJazz.com

Ontario Fractal

The next Ontario Fractal meeting will be about *Complexity Inspired Governance* with Ruth Armstrong. The date is April 6th from 3-5 pm. The meeting will take place at Meta Strategies - Studio 206, 401 Richmond St. West. Ruth Armstrong is president of VISION Management services and has worked with more than 250 public, private and nonprofit organizations in Canada and the US. She helps them create a compelling vision, build accountable organizations and navigate complex environments.

We will be talking about the role and functioning of boards in non-profit organizations using a complexity lens. Please confirm attendance with Liz Rykert at liz@metastrategies.com

May 4th, 2006 - 3-5 pm: The members of the Ontario Fractal will be able to participate in a tour of the new National Ballet School on Jarvis Street. Join other fractal members as they explore the design of the National Ballet School. The school reflects careful thought and understanding of how young people learn both formally and informally. This connection between learning and the

built environment is demonstrated over and over again in the halls, performance spaces, classrooms, library, and central square which serves as reception, food, and centre of all activity. Please [contact Liz Rykert](#) to book a spot on the tour.

Stay tuned for upcoming sessions with Brenda Zimmerman and Cathy Risdon. We have confirmed a date for Cathy Risdon. That session will take place September 21st, 2006 from 3-5 pm. While the topic is still under consideration Cathy has been developing some ideas about new ways to shape the learning process. She is at McMaster University where she holds an endowed Chair looking at relationships in medicine. In this capacity she has been developing a Centre for Excellence in Relationships. We will keep you posted on the topic. We hope you can join us.

If you have an idea for session or a suggestion for speaker please contact Liz Rykert at liz@metastrategies.com . ■



Plexus Calls: Spring 2006

Bringing People Together in Conversation

If you would like to listen to these provocative conversations:

- Dial (563) 843-7000
- Enter access code 301010, followed by “#”

PlexusCalls are scheduled for Fridays from 1 PM to 2 PM Eastern Time. Please check www.PlexusInstitute.org for further details, additions or changes to the schedule.

E-mail your questions before or during the call to PlexusCalls@Plexusinstitute.org

March 31

Smart Networks: What they Are, How they Work

Guests: Kevin Dooley, Lisa Kimball and June Holley

Dr. **Kevin Dooley** is a Professor of Supply Chain Management in the W. P. Carey School of Business at Arizona State University. He holds affiliate appointments with the School of Health Administration and Policy, The Hugh Downs School of Human Communication, and the Department of Industrial Engineering. He holds a doctorate in mechanical engineering from the University of Illinois. He co-authored two patents with Steve Corman con-

cerning Centering Resonance Analysis, a form of network text analysis, and is chief operating officer and cofounder of their company Crawdad Technologies. Crawdad text analysis software is used by dozens of companies and Crawdad is working with the US government anti-terrorism efforts. He is a trustee and past president of the Society for Chaos Theory in Psychology and the Life Sciences, and has published books and more than 100 articles about quality, complexity, innovation and communication. He talks about the “six degrees of connection” and the surprisingly entwined world of human communication in his blog <http://kevindooley.blogs.com>. He is also a Plexus Science Advisor.

Lisa Kimball is executive producer and owner of **Group Jazz**, an organization devoted to supporting teams, task forces, communities and organizations. She earned her doctorate in educational psychology, cognition and learning and is active in online community work and organizational development. She is also a Plexus Trustee and skilled in using complexity-inspired principles.

June Holley is founder and president of the Appalachian Center for Economic Networks (**ACEnet**), a community economic development organization in southeastern Ohio committed to building a healthy and sustainable economy based on economic justice. ACEnet provides services businesses need to start, expand and create quality jobs, and encourages entrepreneurs to network with each other, sharing information and generating joint ventures that allow them to enjoy economies of scale.

April 21

Complexity and Storytelling for Social Change

Guests: Dr. Arvind Singhal, Kate Randolph and James

Palmer

Dr. **Arvind Singhal** is presidential research scholar and professor in the School of Communication Studies at Ohio University. He has studied diffusion of innovation, mobilization for change, and has expertise in using soap operas and other forms storytelling in strategic communication. He is author of several articles and books, including *Combating AIDS: Communication Strategies in Action*, which he wrote with the late Everett Rogers, and *Children of Africa Confront AIDS: From Vulnerability to Possibility*, with editor W. Stephen Howard.

Kate Randolph is senior technical advisor for the New York-based EngenderHealth. She is a former vice president for international programs at Population Communications International. She has worked around the world with media teams to design and broadcast social content soap operas promoting reproductive health and rights and HIV/AIDS education. She has worked with international nongovernmental organizations. She has a master's degree in Arabic and Islamic law from Columbia University.

James Palmer is director of the Caldwell Palmer Group, a consulting firm in Denver, Colorado. His work is focused on healthcare, communities of practice, complexity science, and organizational effectiveness. He researches internationally on human interaction and collaboration as emergent patterns of practice. He has bachelor's and master's degrees in economics from the University of Chicago and is pursuing a doctorate in complexity and human interactions at the Complexity and Management Centre at the University of Hertfordshire, UK.

April 28

Genetic Algorithms and Innovative Problem Solving

Guest: Dr. John Holland

Dr. **John Holland** is known worldwide as the father of genetic algorithms and one of the most visionary thinkers in complexity science. He is a professor of electrical engineering, computer science and psychology at the University of Michigan. He earned his BS in physics from the Massachusetts Institute of Technology and earned a master's degree in math and a doctorate in communications from the University of Michigan. He serves on the Santa Fe Institute Board of Trustees and is a member of the Institute's external faculty. He has been awarded a MacArthur Fellowship and the World Economic Counsel Fellowship, and has authored numerous books and articles. His books include *Emergence: From Chaos to Order*, and *Hidden Order: How Adaptation Builds Complexity*. He is also a Science Advisor for Plexus Institute.

May 12, 2006

Hurricanes, Storms and the Complexity of Weather

Guests: Dr. Greg Holland and Dr. Bruce J. West

Dr. **Greg Holland**, director of Mesoscale and Microscale Meteorology (MMM) at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado is a native Australian and spent much of his career with Australia's Bureau of Meteorology Research Centre, where he focused on tropical meteorology and severe weather and established programs to study the coastal impact of tropical cyclones.

Dr. Bruce J. West is Chief Scientist of the Mathematical and Information Science Directorate at the US Army Research Office. Dr. Holland comes to NCAR from Aerosonde, a manufacturer of lightweight and long-range robotic aircraft, where he played a key role in developing small unmanned vehicles.

Under Dr. Holland's leadership, MMM plans to nest weather research forecasting within a global climate model as part of a substantial program to investigate the way large-scale processes translate into local impacts, and vice-versa. MMM will also augment its research into air quality and the interactions with pollutants and cloud formation and precipitation, the dispersal of pollutants in

the boundary layer, and the mechanisms by which the atmosphere cleanses itself. Dr. Holland's experience in tropical meteorology has enriched studies on hurricane landfall and the heavy rains that often result inland. To advance that research and improve landfall predictions, MMM plans to couple weather research forecasting with an ocean model to study ocean and atmospheric interactions during intense wind and rain conditions. Dr. Holland is also leading a series of computer simulations, using supercomputing time awarded by the National Aeronautics and Space Administration, which will shed light on observed intensity changes in weather and improve understanding of how climate influences, and is influenced by, human activity. Dr. Holland began his career as a mathematician and earned his doctorate in atmospheric science at Colorado State University. Dr. West, who is a Plexus Institute Science Advisor, is an expert in complex systems who has researched climate models and climate change predictions.

May 26

The Mysterious Realm of the Ultra-Cold and a New Way to Examine Molecules

Guests: Dr. Giacinto Scoles and Dr. Larry Liebovitch

Giacinto Scoles is a Princeton University professor who has been awarded the 2006 Benjamin Franklin Medal in Physics. The award, which many researchers view as the American version of the Nobel Prize, is being given to Dr. Scoles and Dr. J. Peter Toennies, who teaches physics at the Universities of Bonn and Göttingen in Germany, for their development of new techniques for studying molecules, including unstable species that could not otherwise be examined, by embedding them in ultra-cold droplets of helium.

Drawing on their insights from chemistry and physics, they discovered hitherto unknown chemical and physical properties of many molecules, ions and atoms could be examined embedding the molecules in tiny droplets of helium in containers at a temperature of minus 459 degrees Fahrenheit. In a story in *The Star Ledger* of Newark, NJ, Scoles is quoted as saying the behavior of atoms in the strange frictionless environment of ultra-cold helium is akin to the behavior of a person who can move easily through a crowd by hopping over and around everyone else. The technique is known as helium droplet spectroscopy. Scoles and Toennies are friendly competitors who talked to each other but reached their discoveries independently and without collaboration.

Scoles was born in Torino, Italy, and began his academic career at the University of Genoa. He taught at the University of Leiden in the Netherlands,

“The behavior of atoms in the strange frictionless environment of ultra-cold helium is akin to the behavior of a person who can move easily through a crowd by hopping over and around everyone else.”

and the University of Waterloo, Canada, and the University of Trento in Italy before accepting a position as Donner Professor of Science at the Princeton University Chemistry Department and the Princeton Materials Institute where he works today. He now divides his time among three institutions. He teaches and does research at Princeton in the fall, and in winter and spring he teaches in the departments of biophysics and condensed matter physics at the International School for Advanced Studies at Trieste. He is also a long-term collaborator at the Elettra Synchrotron Laboratory in Trieste. He speaks and writes in five languages.

Toennies is a Philadelphia native with degrees from Amherst College and Brown University who began his academic career at the University of Bonn and was recently a visiting professor in chemistry and physics at the University of California at Berkeley. Other winners of the Franklin Medal have included Niels Bohr and Albert Einstein.

Dr. Liebovitch is interim director of the Center for Complex Systems and Brain Sciences at Florida Atlantic University. He also has appointments at FAU's Center for Molecular Biology and Biotechnology, the Department of Psychology and the Department of Biomedical Science. He is a physicist and astronomer who has applied nonlinear methods to analyze molecular, cellular, physiological and psychological systems. He has written more than 75 articles and book chapters and is the author of *Fractals* and *Chaos Simplified for the Life Sciences*. ■


Complexity Science: *Knowledge, Learning, & Resources that Advance Nursing Education, Practice & Leadership*

A Workshop for Nurses Shaping 21st Century Health Care

May 31 through June 1, 2006 • The College of New Jersey, Ewing, NJ

- Can our understanding of complex systems help create healthier organizations to promote healing?
- How do the incalculable number of molecular interactions in the human body produce the coordinated behavior of cells and tissues we call health?
- Is treatment of disease influenced by our perceptions of it? And what does an understanding physiological and organizational complexity mean for the future of the nursing profession?

Analyzing these questions may lead to some surprising new realizations. If these ideas capture your imagination, join us for the conference!

 Nursing is the first profession to incorporate complexity science into graduate education at the national level. Eighty-five colleges of nursing across the country are offering a complexity-based approach to training clinical nurse leaders, highly trained professionals whose new role will make innovative contributions to healthcare. Research has already shown that complexity inspired management practices in health care environments can dramatically improve patient outcomes. If you want to learn what complexity science has to offer nursing and the healing professions, this conference will be an exciting event. It is designed for pioneering nurse educators, leaders and practicing nurses who want to discover new scientific insights that will lead to improved education, research and practice. This conference builds on two past educational events: *Creating Healthcare Organizations Where Nurses Thrive*, held in 2004 at Hunterdon Medical Center, Flemington, NJ, and last summer's workshop in Kansas City, *Complexity Science: Opportunities for Nursing Educators*. This continuing educational initiative will explore how members of the nursing profession can use complexity insights to help redesign the healthcare system. Check out website www.plexusinstitute.org to read the flyer about the innovative conference program and distinguished faculty. A complete brochure will be available soon!