

### UNDERSTANDING AND PROTECTING LIGHTNING BUGS, TADPOLES, AND SO MUCH MORE

YOUR SHELTER OR MINE? ROMANTIC RELATIONSHIPS AMONG THE HOMELESS

WHAT'S UP, DOC? THE IMPORTANCE OF GRAVITY IN OUR SENSE OF DIRECTION

INDIANA UNIVERSITY PURDUE UNIVERSITY FORT WAYNE



### A LETTER FROM THE VICE CHANCELLOR Sharing knowledge, experience, and expertise

Through the activities and accomplishments of students and faculty at Indiana University– Purdue University Fort Wayne (IPFW), the Office of Academic Affairs (OAA) supports, sustains, and advances the intellectual, social, economic, and cultural programming that contributes to the growth of our students and the enrichment of northeast Indiana. OAA supports and sustains the comprehensive metropolitan mission of the university by providing strategic vision, on-going review, day-to-day oversight, and fiscal management of IPFW's schools, colleges, and academic departments.

The purpose of our new magazine, *IPFW Connect*, is to provide a forum through which the knowledge, experience, and expertise of our faculty can be shared with the university's friends, stakeholders, and our regional communities. In this inaugural issue topics considered range from the natural and social sciences to health science, public policy, and philosophy. I sincerely hope you enjoy the thoughts and insights offered by our faculty and look forward to the opportunity to introduce additional faculty in future issues.

Thank you for your continuing support of IPFW in its mission to foster the intellectual growth of northeast Indiana.



Carl N. Drummond, Ph.D. Vice Chancellor for Academic Affairs and Enrollment Management Professor of Geology

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# UNDERSTANDING AND PROTECTING LIGHTNING BUGS, TADPOLES, AND SO MUCH MORE

### BRUCE A. KINGSBURY, PH.D., PROFESSOR OF BIOLOGY

Catching lightning bugs in a jar, scooping up tadpoles in a net, or wondering what creature made that strange call in the night. Remember that?

At IPFW's Environmental Resources Center (ERC) some of us are still catching tadpoles in a net, but now we want to know more. How many and what kind are they? What kinds of wetlands are best for them? Are we doing what we need to protect such habitats? And then we are writing and talking about our ideas with scientific and public audiences—and getting more kids out there to get them curious as well.

The mission of the ERC is "to promote the understanding and conservation of the natural resources of the region through scientific research, educational opportunities, and outreach." The ERC is regionally unique as a local, environmentallyfocused organization with substantial research capacity. We are engaged in projects that involve water quality, habitat enhancement, and outreach to the community.

#### WATER QUALITY A BIG ISSUE

ERC activities are not all pollywogs and lightning bugs. A big issue these days is water quality. Aquatic biologist Associate Professor Robert Gillespie (biology) is deep in it, working with student teams to collect water quality data in the rivers and streams of the area. Collaborating with Fort Wayne and not-for-profit entities like the St. Joseph River Watershed Initiative and Tri-State Watershed Alliance, Gillespie and his students explore not only the quality of our river water, but what practices help to clean it up—or not. And this is important. After all, this is where our drinking water comes from, and where folks fish and boat.

And the ERC has helped on issues relating to water quality in other ways, including developing the online Water Quality Information Service (WQIS). The WQIS database provides convenient public access to water quality information for sites along the St. Joseph River and its tributaries. It also allows data entry by scientists, students, and agency personnel so that the dataset expands over time. A wonderful example of the ERC in action, the WQIS is sponsored by the St. Joseph River Watershed Initiative and the city of Fort Wayne, and represents a collaboration with personnel from those partners, Gillespie, his students and staff, and IPFW Professor Emeritus Robert SedImeyer (computer science), among others. New capabilities are being added and our partners are poised to invite other communities to join. Check out the WQIS at wqis.ipfw.edu

#### STUDENT RESEARCH AND THE ERC

Student involvement in research is a large component of the educational side of the ERC. One example is Adam Warrix, graduate student of Assistant Professor Jordan Marshall (biology), who is exploring the use of fire as a tool to control the expansion of invasive shrubs into wetlands. Another is Ryan Smith, a student of mine who is exploring the birds of



Fort Wayne and what factors support increased breeding bird diversity in our remaining woodlands.

Undergraduates are also engaged. During summer 2015, with the help of Gillespie as the principal investigator, undergraduates Justin Martin and Jessica Eash supervised an intensive water monitoring project for the city. Martin and Eash coordinated several teams of field technicians who collected physicochemical data and water samples at 15 sites near Fort Wayne on the three rivers during four wet events. Data from the project will be used to model combined sewer overflow events to help the city better manage them.

### LOOKING FORWARD—GROWING, DIVERSIFYING, AND COLLABORATING

What's next? We want to grow, diversify, and build more collaborative relationships. We will continue to strive to include more partners on and off campus, find more projects for faculty and students, and show the community the value of having IPFW as a neighbor.

An exciting opportunity that stands out is including an environmental stewardship center as part of the current riverfront initiative revitalizing downtown Fort Wayne. Overall, Riverfront Fort Wayne is a visionary endeavor to enhance the development of areas around the rivers while also promoting recreation and entertainment as well as restoration and protection of the rivers and their habitats. I have been working with the city to explore the feasibility of a stewardship center, a facility with a building and grounds designed to offer multiple approaches to environmental education for all ages. The building would be a venue for displays and demonstrations relating to energy efficiency, responsible processing of surface and waste water runoff and ecology. It would also be a place where conferences could be held, classes taught, or private events held, such as weddings.

The grounds would include ponds and wetlands, not only to represent natural habitats of the region, but also to allow staged purification of surface water from the area. Other aquatic and terrestrial habitats would also be represented, and paths and other features would allow recreation and learning opportunities on site.

For more information on the ERC, its projects and programs, or to join in the conversation, see our website and blog at erc.ipfw.edu



Bruce Kingsbury, Ph.D., is professor of biology, director of the IPFW Environmental Resources Center, and associate dean of IPFW's College of Arts and Sciences. His areas of expertise include wildlife ecology, behavior, and conservation. He has a very active research program in conservation and wildlife management, particularly for endangered reptiles.





## YOUR SHELTER OR MINE? ROMANTIC RELATIONSHIPS AMONG THE HOMELESS

### RACHEL L. RAYBURN, PH.D., ASSISTANT PROFESSOR OF PUBLIC POLICY

As a nation of predominantly housed individuals, we often project assumptions and judgments on non-housed individuals, making them one of the most stigmatized groups in our society. Major surveys measuring public attitudes toward homelessness have been conducted over the years to identify the perceived root causes for homelessness. A 2007 Gallup survey found that 85% of Americans think that drugs and alcohol are a major cause of homelessness, with only 18% citing job loss. Most respondents felt communities are safer when people do not live on the street, and even after 30 years of research on homelessness, the stigma of "lazy, drunken, and immoral" individuals is still prevalent.

#### RESEARCH ON HOMELESSNESS HAS NARROW FOCUS

In news reports and research studies on homelessness, we are used to reading about mental health issues, drug use, and

physical health problems, which may lead to the perceptions described above. Further, homeless individuals are often treated or stabilized for mental health and substance abuse issues to avert criminal activity or abnormal behavior in lieu of other issues related to the well-being of the homeless and the society. In addition, the general health of homeless individuals appears to be focused on preventing the spread of diseases to others instead of meeting the health and wellness needs of the homeless. As a result the homeless often perceive interventions as less than compassionate.

Therefore, it is not surprising that throughout the hundreds of studies conducted on homelessness, researchers have neglected to examine one very fascinating and pertinent topic—the love lives of individuals experiencing homelessness. The research that does exist on homelessness and romantic relationships is often pessimistic in tone. If we believe that homeless individuals are idle, intoxicated bums, then it makes sense that we think they should not be involved in romantic relationships in the first place. They should "sober up, take a shower, and get a job," not "get drunk, court one another, and get laid." That said, maybe these high standards are a bit too high, and homeless individuals are a lot like housed individuals when it comes to romantic relationships.

#### STUDIES FOCUS ON PROBLEMS, NOT BENEFITS

Research has shown that romantic relationships are one of the most important components of a person's life satisfaction and well-being. As human beings, we have built-in cognitive mechanisms that help us protect and foster committed romantic relationships. These relationships are not just socially beneficial, but also improve physiological responses. Although romantic relationships are an important component of life, research on love, dating, and sex among the homeless is in an early stage of development. The few studies that exist on these topics focus on the problems and not the benefits of such relationships. Researchers do not look at love and romance within the homeless population, but rather focus on the negative consequences of sexual intercourse. The tone of these writings indicates that society feels the homeless should not be dating, having sex, or falling in love. However, simply because a human being is without a home does not mean basic desires and needs disappear.

The pluses of romantic relationships may prove to not only be beneficial to the homeless, but also to society in general. When individuals enter committed relationships, the ways they exercise, eat, and take care of themselves change for the better. In turn, couples may better accept policies targeting these lifestyle changes than individuals. The studies on the benefits of committed relationships for couples, children, and society are numerous, begging the question if the rewards of romantic relationships, especially those involving long-term commitment, can be found among the homeless.

#### FOCUSING ON A POSITIVE ELEMENT

In spite of the gaps in what we know about homelessness and relationships, researchers have continued to produce a plethora of information regarding sexual intercourse and homelessness. Readers can explore topics such as HIV, sexual abuse, health problems, prostitution, drug use and abuse, and victimization among the homeless. Previous research starts with the most negative characteristics attributed to the homeless. However, in my research I have tried to focus on a positive element within the homeless community by exploring the role of romantic relationships in the lives of the homeless, something I stumbled into by simply talking to the homeless.

I conducted interviews with men and women in homeless shelters for this study. I did not begin the research with formal, testable hypotheses, and had only vague ideas of what I would learn, but I anticipated acquiring more knowledge about the daily schedules and routines among the homeless.



During the interviews, I allowed the participants to talk for as long as they liked on whatever aspects of their lives they wanted to discuss. Interviews and focus groups ranged from one to two hours in length. The primary purpose of these interviews was to find out about sobriety from drugs and alcohol among homeless men and the services provided to them, but many of the individuals chose to talk about romantic relationships.

### FREQUENT MENTION OF ROMANTIC RELATIONSHIPS KEY

One of the most important findings in this study was that information about romantic relationships emerged so frequently during the interviews. This project's original focus was not on love, sex, and romance, but in all interviews conducted, the men interviewed mentioned the importance of romantic relationships on their own accord. Meanwhile, unless prompted with a specific question, the female participants did not generally discuss romantic relationships. Some participants, both male and female, had been in relationships before they became homeless and were trying to work things out while they were living at the homeless shelter. Others were single at the time they began living at the shelter and had since become involved in a romantic relationship. While some participants dated housed companions, others dated those who were homeless themselves.

What was found from these interviews is that although relationship styles vary, there are definite themes among the homeless population when describing this area of their lives. Whereas research has generally shown strong differences in how relationships are viewed and engaged in by gender, both men and women in the study seemed to conduct relationships similarly, and expressed attitudes that mirrored each other. Both genders discussed (1) relationships as important components of their lives, (2) relationships as support mechanisms, (3) the emotional benefits of relationships, (4) the relevance of sexual relations, and (5) troubles in navigating romantic relationships. Aside from one area relationships as support mechanisms—the findings of the study are similar for both male and female participants.

#### SIGNIFICANT OTHER IMPORTANT—FOR ALL

In many ways, relationships among the homeless are similar to those of the housed population. From this study I learned that having a significant other is an important goal in the lives of the homeless. These individuals date, support each other emotionally, and share hopes and dreams. They also engage in physical acts of romance. Also, like housed individuals, they do not always get along and experience disputes, some having serious consequences.

In the homeless shelter where this study was conducted, populations are separated by gender. There is an outdoor pavilion for single men, a residential hall for single women, and a residential hall for single women with children. There are few facilities for families or for single men with children. Therefore families that enter into homelessness must sometimes live separately within a shelter system or live in a tent in the woods. However, while shelter systems understandably have legitimate reasons for separating single men and single women, why do they (or we) not put more emphasis on keeping families together? By providing no choices, we are fostering individualism and alienation instead of cooperation and teamwork.

#### NEED TO EVALUATE FAMILY SHELTERS

Perhaps these structural strains increase the perceptions of homeless people as stigmatized outcasts. Future research should evaluate the success of family shelters versus nonfamily shelters to examine this difference. There also may be advantages in working with couples instead of individuals within homeless shelters. Homeless shelters or similar service agencies still deal with extremely stigmatized groups of individuals. This stigma impedes assistance because the focus is on only certain parts of a person's life. Instead of focusing on an individual approach and, in most cases, forcing separation, shelters may want to consider approaches that allow families and couples to remain together. Focusing on the relationships between individuals and acknowledging their benefits may be a helpful approach to use not only in homeless shelters, but also in other agencies that offer similar services, such as alcohol treatment programs, or provide aid to various groups.

To explain the gap in research on homeless populations, we must consider how homelessness's "master status" affects how it is viewed. In a 1945 article "Dilemmas and Contradictions of Status" in the American Journal of Sociology, Everett C. Hughes established that master status is a personal trait that determines how others characterize an individual. Homelessness has emerged as a master status, so that other roles that a homeless individual possesses (such as father, employee, lover) recede to the background and an individual's primary and defining role becomes that of "homeless." Following Hughes, the master status of homelessness possesses auxiliary traits. For example, the homeless are expected to be male, middle-aged, and downtrodden, so a woman, child, or employed person does not "fit" the stereotypical view of the homeless. Thus, the homeless man or woman in a positive, romantic relationship is an anomaly

in the popular imagination, and unfortunately, it appears that this lack of a regular domicile as a master status has shaped research on the homeless as well as public perceptions.

\*The full version of this article was originally published in *Deviant Behavior* by Taylor & Francis Group. Please see the original publication for full methodology, findings, and reference list: *Deviant Behavior*, vol. 31 (2010), pp. 756–774.

Professor Rayburn is one of the faculty featured in the inaugural edition of The Don Difference, which was released in fall 2015.



Learn more about the series and Rayburn's feature at dondifference.com



Rachel Rayburn is an assistant professor of public policy at Indiana University–Purdue University Fort Wayne (IPFW). She holds a B.S. degree from Florida State University and a Ph.D. in sociology from the University of Central Florida. Rayburn teaches courses in criminal justice, law, and public policy. Her current research examines desistance (cessation of a certain behavior) among homeless

substance abusers. She has published articles on homelessness, drugs, and desistance from crime that have appeared in journals such as *Deviant Behavior*, *Applied Social Science*, *Society*, *The Journal of Long Term Home Health Care*, and *Sociology Health Review*.

## DENTAL IMPLANTS what you need to know

### CONNIE M. KRACHER, PH.D., M.S.D., ASSOCIATE PROFESSOR OF DENTAL EDUCATION



#### A LOOK AT CURRENT DENTAL IMPLANT THERAPY

According to the American Association of Oral and Maxillofacial Surgery (AAOMS) and the American Academy of Implant Dentistry (AAID), 69% of adults 35 to 44 years of age have lost at least one permanent tooth due to tooth decay, gum disease, accidents, or failed root canal therapy. The AAID states that more than 30 million Americans are missing all the teeth in one or both jaws. By age 74, 26% of adults in the United States have lost all of their permanent teeth. When patients lose teeth, they have only a few options for replacement—a partial denture, fixed bridge, or a dental implant. In fact, 15 million people in the United States have bridge replacements for missing teeth, and while only 3 million have dental implants, that number is growing by ½ million implants annually. So, chances are that you or someone you know will need dental implants at some point. The success rate of dental implants has been reported in the scientific literature to be approximately 95–98% according to AAID and AAOMS, national organizations that represent most U.S. dentists who place dental implants. Throughout the world, dentists have been placing dental implants for many decades, with dental implant procedures becoming increasingly successful. Also, unlike porcelain and metal bridge replacements, dental implant procedures do not require the enamel on teeth next to the missing tooth/teeth be removed.

The majority of dental implants today are made from commercially pure titanium or titanium alloy which continues to be used in dentistry because of its rapid reactive metal properties: implants oxidize within nanoseconds when exposed to air, and this oxidized layer then becomes resistant to corrosion. Dental implants also are treated with surface characteristics designed to produce a better connection between the bone and implant, a connecting process called *osseointegration*. Manufacturers also treat dental implants with additive materials or chemicals, such as inorganic mineral coatings, biocoating with growth factors, fluoride, plasma, and other particulates containing calciumphosphates, carbonates, and sulfates.

#### PERI-IMPLANT ANATOMY AND BIOLOGY

When a dental implant comes into contact with body tissues and fluids, within milliseconds, water ions and small biomolecules are absorbed. The process of osseointegration between the implant and the patient's bone can be compared to a bone fracture healing. This process also includes an inflammatory reaction, bone resorption, and the release of proteins by the patient's body that cause cell growth called *growth factors*. A differentiation of the cells into boneforming cells, called *osteoblasts*, leads to bone formation at the implant surface.

The success of a dental implant begins with the initial *immobilization* of the implant on the bone after surgical placement to allow new bone to form around the implant. New bone formation follows a specific sequence. First, woven bone of collagen fibrils forms quickly between the implant and bone. Then, bone grows in all directions at a robust rate of approximately 100 microns per day. After several months, woven bone is replaced by bone called *lamellar bone*, consisting of layers of collagen fibrils leading to dense bone mineralization. Lamellar bone grows slowly, only a few microns per day, and after approximately 18 months of healing, lamellar bone is repeatedly resorbed and replaced as mature bone.

#### **BIOMECHANICAL ASSESSMENT**

The importance of *biomechanics*—or the study of the structure and function of dental implants—was initially underestimated by dental researchers. Subsequent clinical research has shown the significant importance of biomechanics in the success of dental implants. Therefore, a clinical assessment by the dental team is crucial to the patient's implant success. Once bone development is achieved, dental implants will resist the patient's biting force when they eat, clench, or grind their teeth. The *bone response* to the patient's bite, improper implant design, or *parafunctional* habits, such as grinding and clenching may cause microfractures in the bone, which may lead to bone loss and the development of fibrous inflammatory tissue around the dental implant. Excessive biting forces are destructive to bone formation and long-term success of the dental implant. The loadbearing capacity of implants is influenced by several factors, including the size and number of implants, the arrangement and angulation of the implants, and the quality of the bone in which implants are set. When excessive pressure on the dental implants persist, bone loss may continue leading to potential implant failure. Preventive treatments, such as mouthguards, may be considered for patients who clench or grind teeth.

#### CLINICAL EVALUATION AND ASSESSMENT

Dental clinicians will continually reevaluate and assess their patients' dental implants to prevent potential complications. Comprehensive evaluation and treatment planning is essential for dental implant predictability and success. Clinical assessment should also include the cause and duration of past tooth loss, as well as any history of bonerelated complications.

As mentioned earlier, a critical factor in clinical assessment is the biologic connection between the patient's dental implant and bone. Healthy bone is required for initial successful bone formation with the new dental implant, as well as long-term implant success. Prior to the dental implant procedure, the dentist will assess the health of the patient's jaw bone by measuring the diameter and length of the bone using threedimensional radiographic imaging, as well as evaluating the quality of the patient's bone.

Healthy bone has a continuous, uniform outline and a lacy, well-defined core. Large bone marrow spaces and discontinuous or thin, sparse bone will be evaluated by the dental clinician, as these negative variables will contribute to poor dental implant stabilization. If the dentist finds there is poor bone quality, the patient may need additional bone called *bone augmentation* and/or a *sinus lift* with additional healing time to maximize implant-to-bone contact.

Your dental clinician will assess the proposed dental implant site thoroughly to prevent dental implant failure. Inaccurately assessing the location of anatomic structures, such as nerves and blood vessels could lead to implant failure. If needed, bone augmentation or other surgeries will be recommended by the dentist to ensure dental implant success.

### RISK FACTORS—ASSESSING CURRENT AND FUTURE PATIENT HEALTH STATUS

Dentists closely examine their patients' current health status, as poor health can influence successful wound healing after dental implant placement. This pretreatment evaluation includes a comprehensive evaluation of patients' current medical and dental status, including current physiological health, medications, habits such as tobacco use, periodontal evaluation, and compliance with past and current preventive care. Identifying potential risk factors during pretreatment evaluation and quickly recognizing any risk factors that may develop post-treatment will reduce potential dental implant complications for patients.

Medical and systemic issues, such as poorly-controlled diabetes, osteoporosis, radiation therapy, bisphosphate therapy, immunosuppression medications, and immunocompromising diseases are risk factors that will be discussed. Behavioral conditions that may interfere with treatment and post-treatment care include tobacco use, substance abuse, and parafunctional habits, especially any oral habits, such as clenching and grinding. Current infection, such as periodontal gum disease or other pathologies (diseases) of the oral cavity should also be part of the comprehensive evaluation used to determine if the patient is an appropriate candidate for dental implants or another type of prosthesis, such as bridges or partial dentures.

### RISK FACTORS—GENETIC SUSCEPTIBILITY AND IMMUNOLOGY

A patient's exposure to specific disease-causing bacteria and the patient's immune response determines the potential for oral diseases, such as periodontal disease, which can contribute to implant failure. The role of the patient's inherited DNA and other risk factors, called a *genetic predisposition*, creates a complex combination of variables that determine if or when a disease may affect the patient.

These variables also determine how the disease will progress and how the patient will respond to dental treatment. The interaction between the bacteria in a patient's mouth and their immune response vary widely among individuals. A body's own innate immune response to infection is what contributes to the destruction of gum tissue and bone by causing an inflammatory response. The elevated levels of antibodies our body creates as a reaction to the infection and that specific inflammatory response can cause an increase in localized destruction of oral tissues. For example, specific antibodies are linked to both periodontal gum disease and systemic illnesses, such as cardiovascular disease or rheumatoid arthritis.

*Peri-implant mucositis* is an infection of the tissue around the dental implant. This condition is similar to *gingivitis* with natural teeth. *Peri-implantitis* is another inflammatory process in the gum tissue around a dental implant, resulting in loss of both gum tissue and bone. This condition is similar to the periodontal disease called *periodontitis* that develops around natural teeth. Risk factors for periimplantitis include poor oral hygiene (not effectively removing plaque daily), current or past diagnosis of periodontitis, cigarette smoking, and diabetes.



Even though the relationship between peri-implant mucositis and peri-implantitis is similar to periodontal disease with natural teeth, the severity and rate of disease progression appears to be more pronounced around dental implants. Although the milder form of periodontal disease called peri-implant mucositis can be effectively treated with professional cleanings by the dental team, success does not appear to be predictable with the more severe form of periodontal disease around dental implants called periimplantitis. It is vital that patients who have dental implants see their dental team on a regular basis and have an individual professional dental care timeline from their dentist.

### FACTORS AFFECTING LONG-TERM DENTAL IMPLANT SUCCESS

The goal for patients with dental implants is the successful healing of gum tissue and bone. Post-surgical treatment includes continual comprehensive clinical assessment of the patient's peri-implant tissues by identifying any current risk factors patients have that may affect their dental implants. The dental team will question their patients about any pain or concerns regarding their dental implants, review current medical status, perform a clinical evaluation of the gum tissue and bone around the dental implants, and review their patient's home care (brushing and flossing) at each dental appointment. Any plaque and calculus, also known as tartar, that accumulates around the dental implant and natural teeth, signs of inflammation and swelling, gum tissue color, consistency, or contour changes around the dental implant are identified and discussed with the patient.

Peri-implant gum tissue is similar in structure and clinical appearance to gum tissue around natural teeth. Gum tissues surrounding dental implants also have the same inflammatory response to plaque accumulation as natural teeth. It is expected that approximately 1.2 mm marginal bone loss occurs the first year after the dental implant placement and 0.1 mm per year afterward. However, higher levels of bone loss is not normal. With dental implants it is imperative for the patient to avoid excessive forces, including biting hard during the early stages of the dental implant healing. The patients' bite should be checked at each subsequent dental examination, as it can change. Dental implant patients who grind or clench should receive a mouthguard.

Many variables can interfere with the success of dental implants. The early detection, prevention, and treatment of periodontal disease by the dental team is imperative. However, patients' home care (removing dental plaque daily) plays a vital role in the initiation and destruction of gum tissue and bone around dental implants. Patients with dental implants should use a soft-bristled manual or power toothbrush, non-metal interdental aids such as floss, and water irrigation (i.e. Waterpik) to disrupt plaque daily. Patients who are interested in dental implants should consult their dental professional to see if they're a good candidate.

\*To read research articles by the author on this topic, see: C. M. Kracher, "Peri-implant Postoperative Treatment Considerations to Prevent Periimplantitis" in *World Dental Reporter*, Spring 2011, volume 3, pages 17–19, and C. M. Kracher, "Dental Health Maintenance of Dental Implants" in *Dental Assist*, Mar/Apr 2010, volume 79, issue 2, pages 27–35.



Connie Kracher, Ph.D., M.S.D., is associate professor of dental education at Indiana University–Purdue University Fort Wayne (IPFW). She received a Ph.D. from Lynn University in Boca Raton, Fla., and a Master of Science in Dentistry in the Departments of Oral Biology and Diagnostic Sciences from the Indiana University School of Dentistry. Kracher is a consultant for the American

Dental Association Commission on Dental Accreditation. She has published in multiple dental journals and has been asked to present at national and international conferences, such as the American Dental Association, American Dental Education Association, and the World Dental Federation. She is a member of the American Association of Dental Research and Academy of General Dentistry. Contact the author at kracher@ipfw.edu.

### **DEPARTMENT OF THEATRE**



INDIANA UNIVERSITY-PURDUE UNIVERSITY FORT WAYNE COLLEGE OF VISUAL AND PERFORMING ARTS

## IPFW 2016–2017 PERFORMANCE SEASON





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### **Blithe Spirit**

Directed by Craig A. Humphrey Sept. 30, Oct. 1, 6, 7, 8, 2016-8:00 p.m. Oct. 2, 2016-2:00 p.m.

Six Characters in Search of an Author Directed by Bev Redman Dec. 2, 3, 8, 9, 10, 2016-8:00 p.m. Dec. 4, 2016-2:00 p.m.

#### Stupid F\*@% ing Bird Directed by Jeff Casazza February 17, 18, 23, 24, 25,

February 17, 18, 23, 24, 25, 2017-8:00 p.m. February 19, 2017-2:00 p.m.

### **Little Shop of Horrors**

Directed by Bev Redman April 20, 21, 22, 26, 27, 28, 29, 2017-8:00 p.m. April 23, 2017-2:00 p.m.







**IPFW MUSIC** 

Complete concert listings for Fall 2016 are posted in August. www.ipfw.edu/concerts

DEPARTMENT OF MUSIC INDIANA UNIVERSITY–PURDUE UNIVERSITY FORT WAYNE COLLEGE OF VISUAL AND PERFORMING ARTS





### EPISTEMIC HUMILITY

(n.) Recognizing the uncertainty of knowledge.

## DON DIFFERENCE

Professor Schwab is one of the faculty featured in the inaugural edition of The Don Difference, which was released in fall 2015.

Learn more about the series and Schwab's feature at dondifference.com

### REPRODUCING SCIENTIFIC RESEARCH THE COMMON SENSE OF EPISTEMIC HUMILITY

### ABRAHAM P. SCHWAB, PH.D., ASSOCIATE PROFESSOR OF PHILOSOPHY

I started my college career as a physics major. Our first semester physics class included a lab, and I remember one demonstration in particular. We used a machine called a Behr Free Fall apparatus that, with the help of a spark generator and spark tape, allowed us to measure the rate a heavy object (called a *plummet*) fell to earth. In a rather unsurprising turn of events, the plummet fell to the earth at a rate of 9.8 m/s<sup>2</sup>.

This lab experiment was not an attempt to discover something novel or unusual. An educational exercise, it also served as a replication of previous experiments. It reproduced a conclusion in science—the acceleration rate due to gravity.

Imagine, though, that our results hadn't matched the received wisdom. Imagine that our results had come back at 9.0 m/s<sup>2</sup>. Of course, operator error would be the assumed cause. But if it was clear we had run the demonstration correctly, that we had not made an error in measurement or calculation, this would shake the foundation of scientific inquiry into the effects of gravity.

### INCREASINGLY, ATTEMPTS TO REPRODUCE STUDIES HAVE FAILED

This is the kind of problem faced by research in the fields of medicine and experimental psychology right now. For the last six years, there have been increasing numbers of attempts to reproduce previously published studies in these areas. And these attempts have returned dismal results. In medicine, two attempts to replicate study results in oncology, women's health, and cardiovascular disease successfully replicated the results of previous studies at a surprisingly low rate. A study in *Nature Reviews Drug Discovery* from 2011 reported successful replication in only about 1 out of 10 published results. In 2012, a study in *Nature* was successful in only about 1 out of 4.

In psychology, *The Psychologist* published results that found successful replication for about half of studies. In perhaps the most comprehensive attempt to replicate psychology research, the Open Science Collaboration was able to successfully replicate the results of all studies published in 2008 in 7 out of every 10 studies. But a 2014 attempt at reproducibility by the Center for Open Science could only reproduce similar results in 39 out of the 100 studies.

Importantly, the reproducibility problem may not be limited to medicine and psychology. There are also concerns about reproducibility in synthetic chemistry and the biological sciences in the background of medical research.

### RESULTS THAT CAN'T BE REPRODUCED CREATE A SPECIFIC CHALLENGE

Scientific research uses rigorous methods to produce results that can be reproduced at different times by different people. Ideally, using the same method to look at the same problem will (re)produce the same result. Results that cannot be reproduced create a very specific challenge—they suggest that any conclusions drawn from the original research are contingent or arbitrary. That is, if results cannot be replicated or reproduced, the conclusions cannot be treated as meaningful outside of that specific experiment. Research that can't be reproduced isn't (or shouldn't be!) contributing to the knowledge base of scientific inquiry and application.

The surprisingly limited success in reproduction in psychology and medicine has two important practical implications. First, a greater sense of what is called *epistemic* 

*humility* is required. In short, we achieve adequate epistemic humility when we recognize and communicate the uncertainty attached to the things we claim to know. Second, we need more caution about our common sense. Despite an often-invoked contrast between common sense and science, science often provides the basis for common sense. If some of our scientific conclusions are less certain than

There are known knowns. These are things we know we know. We also know there are known unknowns. That is to say, we know there are some things we do not know. But there are also unknown unknowns. The ones we don't know we don't know.

—Donald Rumsfeld, U.S. Dept of Defense news briefing [transcript], February 12, 2002.

Even though identifying criteria for knowledge may be useful in some ways, epistemic humility guides us as we act based on our current state of uncertainty. Whether or not the doctor knows, the doctor recommends. Whether or not the psychologist knows, the psychologist suggests. Epistemic humility demands that these recommendations and these suggestions be accompanied by explicit recognition of their uncertain character.

The problem of reproducibility indicates worrisome uncertainty in some research backing the practice of medicine and psychology. In the ideal model, practice is based on the

> robust conclusions of research. If practice patterns depend on unreproduced research, those practice patterns may rest on a house of cards. To borrow language from John Ioannidis' 2012 article in *Perspectives on Psychological Science:* this practice will rest equally on "unconfirmed genuine discoveries and unchallenged fallacies."

Until the reproducibility

expected, we have to be careful about our explicit or subtle uses of science to inform our common sense.

### EPISTEMIC HUMILITY FOCUSES ON THE UNCERTAINTY

A great deal of ink has been spilled by philosophers attempting to define the criteria for claiming to know something with certainty. But the demands of epistemic humility are agnostic about competing theories of knowledge. Instead, epistemic humility focuses on the uncertainty attached to claims of knowledge. problem has been adequately addressed through changes in the fields of psychology and medicine, practitioners and policy makers (and their critics) should accept much slower (and thus less exciting) progress and should readily recognize and express the fact that we simply don't know all that we thought we did.

### COMMON SENSE DEVELOPS FROM OUR CONSUMPTION OF SCIENCE

Nada Gligorov, in a manuscript I reviewed, makes the insightful point that common sense rests on a scientific foundation. What we take to be common sense builds, explicitly or implicitly, on the conclusions of scientific inquiry. As Gligorov notes, recognizing this connection undermines the view that science and common sense are at odds with one another.

When science contradicts existing common sense, it is laying the foundation for future common sense. As the well-known truths of science shift, common sense begins to shift. It is known now that different kinds of calories produce different effects on health and weight, but it didn't used to be. It is known that we unconsciously filter our experience for confirmation of our existing beliefs, but it didn't used to be. It is known that consistent tobacco use has many negative health effects, but it didn't used to be.

As noted above, the reproducibility problems with science suggest humility and caution about our uses and adoption of new science. Because our common sense develops from our consumption of science, there are two problems. First, the science reporting that informs our common sense may misrepresent or exaggerate the conclusions of the science. Unscrupulous journalists intentionally exaggerate the findings of science to garner more attention. Even conscientious ones may struggle to explain it accurately. While these issues are serious and should encourage careful skepticism of science reporting, the reproducibility problem runs deeper.

If somewhere between 3 and 9 out of every 10 published studies in medicine and psychology cannot be reproduced, even using accurately reported conclusions can lead to poor judgment. As John Doris puts it in an excerpt from his recent book, *Talking to Our Selves: Reflection, Ignorance, and Agency:* "Don't lean too heavily on any one study, or one series of studies . . . all the more so, where there have been difficulties with replication." For our common sense, then, we have epistemic reasons to be slow adopters of any new conclusions in medical or psychological science. When you read about a new conclusion, not only should we confirm the accuracy of the reporting, but we should be mindful of its uncertainty. It might be helpful to remind ourselves "that might not be true" after every new report.

### SCIENCE CAN MITIGATE, NOT ELIMINATE UNCERTAINTY

Personally, I've begun to think of new science like new operating systems for my phone or my computer. If I'm an earlier adopter, I'm going to end up enduring a lot of missteps and backtracks as the real applications of the science are adjusted. Because I tend to be a late adopter of new operating systems, perhaps it's unsurprising that I also don't get particularly excited about any new study.

Finally, it's important for us to be aware of the reproducibility problem in several areas of scientific inquiry. It reminds us that science can mitigate but cannot eliminate uncertainty. It highlights the lingering uncertainty in new and novel (and sometimes old and worn) conclusions of scientific inquiry. And it emphasizes the explicit skepticism with which we should view all reports of new scientific conclusions.



Abe Schwab, Ph.D., is an associate professor of philosophy at IPFW. He earned a Bachelor of Arts from Drake University in 1998, a Master of Arts in 2001, and a Ph.D. with distinction in 2005, both from Loyola University Chicago. His research interests include research ethics, clinical decision making, and autonomy in health care.

# WHAT'S UP, DOC?

### THE IMPORTANCE OF GRAVITY IN OUR SENSE OF DIRECTION

### RYAN M. YODER, PH.D., ASSOCIATE PROFESSOR OF PSYCHOLOGY

Efficient navigation is a necessary part of our daily lives. From walking around the house in the middle of the night, to efficiently taking a detour around a closed street, to finding our car in a crowded parking lot, we would essentially be lost if we were unable to learn to navigate accurately. The importance of navigation is even more apparent in debilitating disorders, such as Alzheimer's dementia, which can cause the sufferer to lose memories about locations and routes. While the neural mechanisms that facilitate navigation have been heavily studied for many years, we are only just beginning to understand each separate sensory system's role in this process.

### SOME NON-VISUAL INFORMATION ORIGINATES IN THE VESTIBULAR SYSTEM

Each sensory system provides unique information that can be used to guide navigation. For example, humans often navigate by relying predominantly on vision, but navigation is also relatively accurate in darkness. At least some of this non-visual information originates in the vestibular system the inner ear sensory system that detects gravity and regulates balance and movement. This poses a problem for navigation where the microgravity environment removes the normal sensation of gravity, like outer space.

Most of our understanding of the brain mechanisms underlying navigation comes from animal research, which allows us to directly record brain activity. For example, navigating from one point to another requires accurate representations of location and direction, and these representations are provided by *place cells* and *head-direction cells*, respectively. Each place cell becomes active when the subject is in a specific location, whereas other locations are represented by other place cells. Each head-direction cell becomes highly active when the head is pointed in a specific direction, whereas other directions are represented by other head-direction cells. These cells thus represent unique aspects of navigation, and the studies performed in my lab at IPFW are designed to offer insight into the relation among vestibular function, brain activity, and navigation.

### SIGNALS FROM OTOLITH ORGANS NEEDED FOR SENSE OF DIRECTION, BUT NOT SENSE OF LOCATION

Our recent studies revealed that navigational performance depends on signals from the *otolith organs*—the specific part of the vestibular system that detects and responds to gravity and linear movement. These studies tested geneticallymodified mice that were born with dysfunctional (faulty) otolith organs. Across several different tasks, otolithdeficient mice appear to be impaired at choosing which direction offers the most efficient path to a goal, but the faulty otolith organ does not impair the ability to recognize a goal once the animal arrives at that location. Thus, signals from the otolith organs—which allow the animal to perceive its orientation relative to gravity—are necessary for an accurate sense of direction, but are not necessary for an accurate sense of location.



Overall, our studies have determined which aspects of visual and non-visual navigation involve signals from the vestibular system. While this information offers important insight into the challenges associated with space travel, understanding how these processes work is also useful in the development of treatments for vestibular dysfunction for those of us on Earth.



Ryan Yoder is an associate professor in IPFW's Department of Psychology. He received a B.A. *cum laude* in psychology from the University of South Florida (1998), followed by an M.A. (2002) and Ph.D. (2005) in Experimental Psychology from Bowling Green State University. His graduate studies focused on brain systems involved in learning and memory, using rodents as a model system.

Yoder then assumed a postdoctoral position at Dartmouth College, where he focused on the sensory signals that contribute to navigation. Since joining the psychology department at IPFW in 2010, the majority of Yoder's research has evaluated the vestibular system's contribution to navigation and associated brain functions, such as the experiments discussed in this article.



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