

GOLD PAPERS

SPOTLIGHTING IMPACTFUL RESEARCH

FALL 2022



ISSUE 7

[GOLDPAPERS.COLOSTATE.EDU/](https://goldpapers.colostate.edu/)

about the *Gold Papers*

From deep within the belly of the Food Science and Human Nutrition department at Colorado State University, came the idea for this project. A motley group of graduate students decided to clarify some of the confusion surrounding "health" while honing their scientific communication skills. This gave rise to the birth of the *Gold Papers*—a CSU flavored spinoff to White Papers, which aims to summarize current research and perspectives in their fields of expertise.

Patient vs Client: What's in a Word?

By Jen Felker

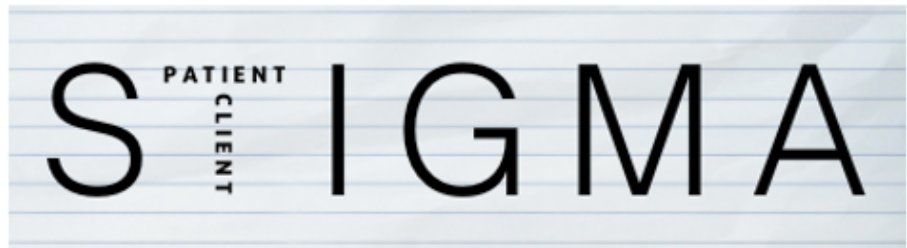
On a brisk spring day, I was sitting in a classroom settling into my ninth month of medical school. The rhythm of each course had finally become second nature and medical jargon my second language. I looked down at my calendar to find the words “Mind and Behavior” staring back at me. I was thankful that my undergraduate degree was in Psychology as I knew what we were about to learn in the next 3 weeks would be vastly different from the rest. My new vocabulary continued to expand, adding words like countertransference, sleep-wake disorder, and paraphilia, but one word stuck out to me above all the rest: client. At first it seemed like a trivial substitution for “patient”, but the weight of a word is far heavier in the realm of mental illness.

Many decades ago, the field of psychology decided to steer away from the word “patient” citing that the medical implications associated with the word didn’t accurately describe the population it was being applied to ([Wing, 1997](#)). The underlying reasoning for this assertion varies widely from one context to the next. Here, I summarize the three main themes arguing for the use of the word client to refer to those receiving mental health care.

Those who are seeking preventative psychological care are not ill (Pluckhan, 1971).

The webster definition of patient is “a person who receives medical care or treatment”. In the

instance of preventative talk therapy, the person receiving the service may not be currently ill or distressed and is therefore not receiving medical care or treatment. Rather they are doing the



psychological equivalent of going to the gym to prevent illness from occurring. In scenarios like this one the term client is more appropriate.

Clinicians are providing a voluntary service ([Herzberg, 1990](#)).

The term client is more aligned with a customer deciding to purchase a service that they have personally decided that they want or need. Many people with mental health disorders voluntarily seek out counseling and treatment and this agency should be reflected in the words used to refer to those people. Furthermore, the relationship between clinician and client has a more even power dynamic and is seen as a partnership in lieu of a hierarchy.

Using a medical term can increase stigma and prevent treatment (Pickering, 1991).

Mental illnesses have been stigmatized since the day they were discovered. Labeling someone as a patient implies that they have a legitimate illness and therefore something is inherently “wrong with them”. This is true of any pathology, but when the area of disease shifts from a faulty heart valve to a core personality trait the

personal ramifications can be more detrimental. This stigma may lead to fewer people voluntarily seeking out treatment in fear of being labeled.

Although these three core reasons have the well-being of the person receiving mental health care in mind, in my opinion there are some fatal flaws in each argument which I have outlined below.

Preventative treatment delivered by a clinician is medical care.

In the world of traditional medicine preventive care is still considered medical in nature and we still refer to those coming in for annual check-ups as patients. I do not see the reason to switch the verbiage from patient to client just because we are now preventing depression rather than diabetes. Medical professionals are still the ones administering care and medications may be used in both instances in preventative methods.

Medical care is provided regardless of patient agency.

Many people seek out medical intervention voluntarily and this has never made them any less of a patient in the traditional sense of the word. Although historically there was a stark power dynamic between patient and provider, that has dissipated over the years with greater emphasis placed on patient autonomy and value-based care ([Teisberg, 2020](#)).

This weakens the argument that client and clinician infers a more even hierarchy than currently exists in the world of medicine. Even so, there are some instances within medicine where the safety of a hierarchy is needed. Mental health care is one of the few circumstances where care can be provided involuntarily. For example, a 72 hour hold can be placed on those who are an imminent danger to themselves or others,

both of which usually stem from mental illness ([Morris, 2020](#)). Using "client" in these scenarios does not accurately depict the severity and complexity of the situation and loses sight of the fact that the real issue is illness.

Using alternate, non-medical terms perpetuates stigma.

Stigma is a prominent obstacle in the treatment and prevention of mental health disorders. I can understand why practitioners would be inclined to avoid making people feel like there is something wrong with them by using the word client instead of patient. However, I believe this substitution perpetuates stigma because it refuses to acknowledge that yes there is something wrong with those who have mental illness. Just like cancer or heart disease, however, it is not the patient's fault that they have that illness. In all of these instances, behavior could have been modified to prevent the disease, but at the end of the day there was still a genetic predisposition and uncontrollable factors that led to the outcome. Only once we fully accept that mental illness is no different than physical illness will stigma cease to exist. This can begin with unifying the language we use.

We may think we are protecting those needing mental health care by tailoring our language to make treatment more approachable, but in reality we are treating a symptom instead of the societal disease of stigma against mental health disorders and wellness. We need to do better to normalize mental illnesses and their treatment as a profession and society. We can take the first step by using the same word to describe everyone who seeks care: patient.

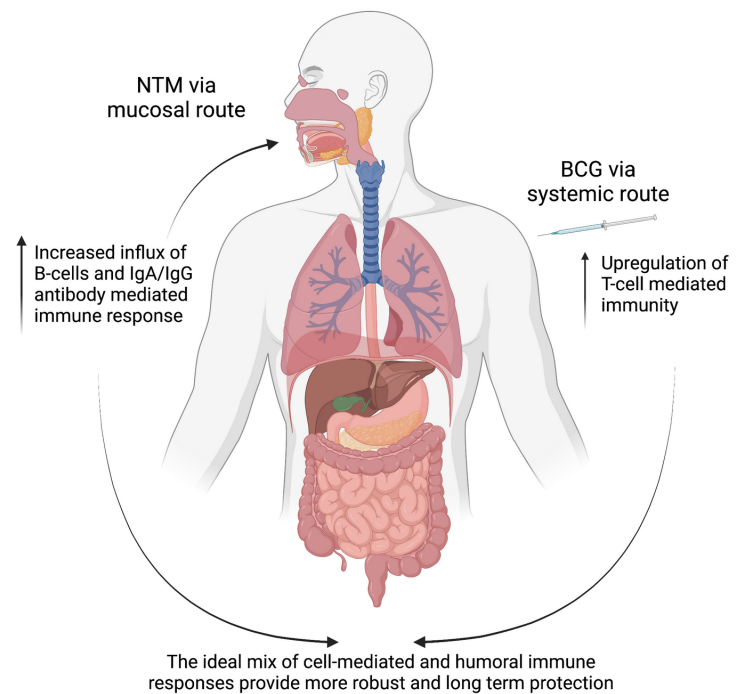
Can We Rethink the Hygiene Hypothesis to Design a Tuberculosis Vaccine?

By Taru Dutt, PhD

Humans and microorganisms have evolved together over time. We are surrounded by microbes, and the number of resident microbes to human cells is close to equal, virtually one-to-one. The human immune system has largely developed through repeated infections with a wide variety of microbes that do not cause disease. This is the result of prolonged exposure to an abundance of microorganisms (e.g., farms, animals, untreated water sources, etc.). However, due to better hygiene and medical care, these “microbial allies” have been mostly eradicated from industrialized societies. This has led to an increase in autoimmune and allergy illnesses, and a decrease in immunological resistance to pathogenic infections. According to the “[hygiene hypothesis](#)”, excessively clean settings do not provide sufficient exposure to pathogens to “train” the immune system to activate defense responses against infectious organisms resulting in the absence of an immune response when individuals are exposed to virulent pathogens.

Therefore, to develop better vaccines and therapeutics, it is essential to understand the relationship between humans and microbes and to consider the [equilibrium model of immune function](#). This model describes the immune system as a dynamically regulated entity that maintains a balance between antagonistic responses with both cross-protective and cross-repressive mechanisms.

Tuberculosis (TB), also known as *Psithisis pulmonaris*, the white plague, and consumption, is caused by the bacteria *Mycobacterium tuberculosis* (Mtb) and is one of the oldest



known human diseases.

For over 70,000 years, Mtb has infected an estimated 2 billion individuals worldwide. Nearly a third of the world's population is currently infected with the TB bacillus and at danger of developing active disease, and approximately 10.4 million new TB cases are reported yearly. Currently, [Bacille Calmette Guerin \(BCG\)](#), a live-attenuated *Mycobacterium bovis*, is the only licensed vaccine against TB. However, the reported efficacy of the BCG vaccine against pulmonary TB has ranged from 0% to over 80%.

Why such variability? Numerous explanations exist including variation in TB virulence, genetic vulnerability of the population, and BCG potency. The most plausible explanation for this phenomenon, however, is differential exposure to environmental mycobacteria also known as non-tuberculous mycobacteria (NTM).

Non-tuberculous mycobacteria are a pervasive opportunistic pathogen in the environment and exposure to them is inevitable. Interestingly, TB-endemic nations have higher NTM populations in the environment; these are also the countries where we find more resistance to active TB infections. We wanted to know how NTM affect the immune system, especially as it relates to TB. To answer this question, we developed a murine model that simulates the human BCG vaccination regime and typical NTM exposure in endemic countries, including (1) BCG vaccination at an early age, (2) exposure to viable NTMs via drinking water (1000 CFU/mL for developed countries, 1.0×10^5 CFU/mL for developing countries), and (3) maintained continuous NTM exposure throughout the study.

Our research demonstrates that exposure to NTM via drinking water (the same way humans are exposed to NTM) induces a protective immune response in our mouse model and protects from future Mtb infection. Our findings also show that BCG induces **systemic TB-specific immune responses while NTM induce robust mucosal immune responses.**

This results in an ideal mix of mucosal and systemic immune responses relevant for protection against TB infection and disease development.

These findings corroborate the "hygiene hypothesis" in that exposure to a non-virulent form of a pathogen may provide protection against its lethal form. This approach has been used to generate numerous vaccines, including those for smallpox and polio, and has been the most successful vaccination strategy till now.

However, can we reaffirm the hygiene hypothesis and use NTM as a mucosal vaccination against TB? Oral vaccination with NTM may be possible, though immunocompromised patients should exercise caution when considering this therapy as NTM might cause lung disease or exacerbate lung disorders, such as Cystic Fibrosis. Careful thought must be given to how NTM is provided, to whom it is supplied, and how frequently it is administered. Alternatively, we can create an "inactivated" form of NTM, which retains all the protein and lipid antigens of the bacteria but lacks the virulence components and is, therefore, incapable of causing illness.

Nature presents us with both obstacles and opportunity. We must just recognize the chances and utilize them more effectively. NTM have the potential to save lives if they can give long-term protection in both immunocompetent and immunocompromised individuals. To properly comprehend its potential as a TB vaccine, we require additional research, deeper understanding, and collaborative efforts.

Borderline Personality Disorder: Unraveling the Stigma of a Treatable Condition

By Martin Maxwell, LCSW



Stigma involves discrimination or negative attitudes towards someone based on a distinguishing characteristic. It's well established that the stigma of mental illness leads to decreased **help seeking behaviors**, less comfort with mental health treatment, and negative influences on **provider decision making**. Among the most stigmatized mental health disorders are personality disorders. This is likely fueled by a combination of misunderstanding for what these disorders truly are, mixed with a false and often deep-seated belief that they are 'untreatable'. The good news is that providing education and familiarity with those suffering from mental illness can markedly decrease the **stigma of mental illness**.

The origins of Borderline Personality Disorder (BPD) are almost as confusing as the name itself. First proposed by Adolf Stern in 1938, the term "borderline personality" was used for a group of patients who did not have the severity of delusion or hallucination for a diagnosis of "psychosis", but whose symptoms were too serious for a diagnosis of "neurosis". Thus, these patients seemed to be on the **borderline** between the two states of illness.

BPD is a complex disorder, and its presentation can vary widely. General features include difficulty maintaining long-term relationships and frantic efforts to avoid real or imagined abandonment by others.

An unstable self-image leads to chronic feelings of emptiness, and often self-harming and suicidal thoughts or actions. Emotional instability leads to moods that can rapidly shift from anxious, depressed, angry, or euphoric within hours and the symptoms of BPD can be severe enough to include stress-related paranoia, dissociation, or other symptoms that may be confused with psychosis.

Due to the severity of these symptoms, living with BPD is very difficult and extremely isolating. Unsurprisingly, BPD is associated with a decreased **quality of life**, impairment of function, poor health outcomes, impaired social functioning, suicidal behaviors, and high rates of **substance abuse**. Estimates suggest as many as 78% of individuals with BPD develop a substance use disorder at some point in their lives. More troubling, those with BPD have a 5-10% chance of completing suicide which is **400 times** that of the general population. This is despite many trained mental health professionals believing these individuals are at low risk for suicide completion.

Personality disorders are among the most common classes of psychiatric disorders, experienced by around **15%** of the U.S. population. The true number of those suffering from BPD is difficult to estimate, as many with the disorder go undiagnosed, **do not seek treatment**, or are misdiagnosed. Often this is the result of misunderstanding and stigma surrounding the diagnosis, including practitioners not assigning the appropriate diagnosis for fear of upsetting the patient. Practitioners may also harbor negative beliefs about BPD or believe that there are no effective treatments. These erroneous assumptions prevent people from being referred

to effective treatment. In actuality, BPD is very treatable, and often curable. One prospective study of 290 patients with BPD showed that remission rates (defined as not meeting BPD diagnostic criteria for at least 2 years) were 35% after **2 years**, 91% after **10 years**, and 99% after **16 years**. Researchers also found that 78% of those individuals achieved remission for at least **eight years**. So why is this stigma so hard to break?

BPD is born from trauma. While genetics may play a role in emotional sensitivity, self-soothing, and impulsivity, often there is some form of childhood physical or sexual abuse, or other **traumatic experience**. This can be different from the type of trauma associated with post-traumatic stress disorder (PTSD), which requires a person be exposed to “actual or threatened death, serious injury or sexual violence” (American Psychiatric Association, 2013). The type of trauma associated with BPD, known as invalidation, is more insidious and recurrent. For example, an impatient parent tells their inconsolable child that they’ll give them something to cry about or ignores a child’s pleas for attention until they’re so despondent that they throw a temper tantrum to get the affection they need. Invalidation creates a distrust of one’s own emotional states and a hypervigilance about their social environment as they constantly scan for clues as to how they are supposed to feel rather than trusting their own emotions.

Because the symptoms of BPD are so uniquely severe and unpredictable, misdiagnosis and a misunderstanding of the disorder often leads to worsening symptoms. Individuals with BPD do not stagnate in the wrong treatment, they

deteriorate. For these clients, spending an hour each week processing crises while receiving unconditional support in traditional talk therapy provides the acceptance the client is craving, but with an inappropriate focus on crisis. This reinforces that so long as the patient has a crisis to process, they will receive acceptance and care. In turn, strengthening the client's maladaptive behavior patterns and hindering their shift towards effective coping strategies. Appropriate treatment instead reveals that the root of the individual's suffering and dysfunction is not the result of stressful life events which are outside of their control, but rather the way they respond to these stressors. A focus on things outside of our control leads to hopelessness and decompensation, while focusing on changing our reaction to stressors is liberating and helps create a sense of self-efficacy needed to heal from past trauma.

Misunderstanding how to properly treat and work with patients suffering from BPD can perpetuate the vicious and frustrating cycle, whereby worsening symptoms are mislabeled as

"manipulative" or "dramatic" by the counselor resulting in the same invalidation from which BPD is born. This increases suicidal gestures, depression, impulsivity, or even anger within a client as they retreat to the only behaviors they know can keep them safe from rejection. In many cases, this forces a client to seek a new counselor, continuing the pattern of relational instability and creating a microcosm within which the individual is forced to relive their childhood traumas over again in their adult life.

When we view this cycle of behaviors within the context of trauma, we can see how rejecting someone for their outbursts is the same as rejecting someone with PTSD because they had a flashback or rejecting an amputee because they had a phantom pain. These behaviors are not a signal of failure, rather, they are the direct result of ineffective diagnosis or treatment. Through education and work to uncover personal stigma surrounding BPD, patients and clinicians can learn how to avoid this cycle of re-traumatization and make strides towards recovery.



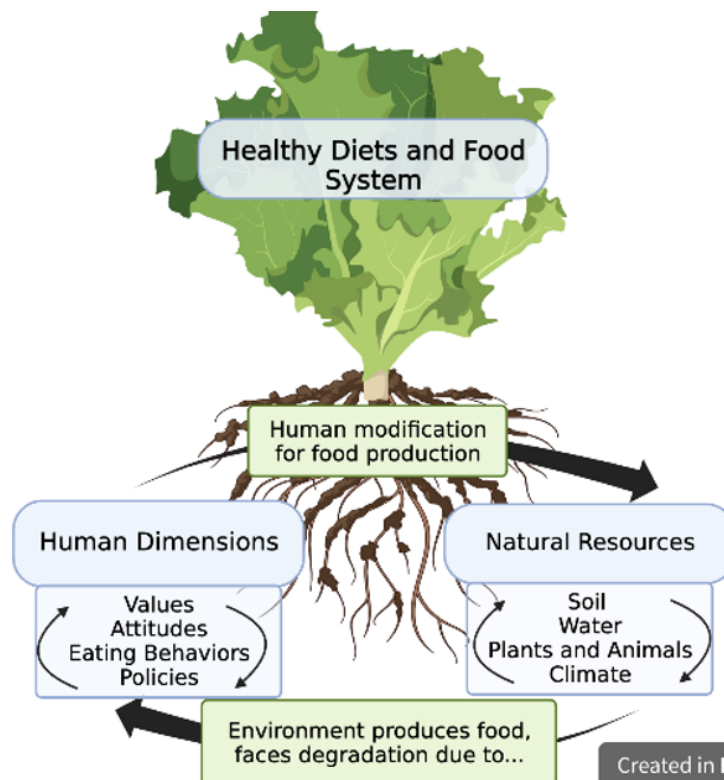
Human Dimensions for Healthy Futures

By Jenna Bensko

Dietary patterns can both support and damage human health, in addition to the health of the environment. Currently, consumer behavior within the United States has been detrimental to the health of both. As such, wide scale adoption of diets with low environmental impact, specifically those which promote plant-forward diets, presents an opportunity for both climate change mitigation and health benefits for consumers. Achieving a state of balance where both humans and the environment are kept healthy is an exceedingly complex task without a simple solution. However, the field of Human Dimensions of Natural Resources yields theory frameworks that are applicable to developing sustainable nutrition interventions. With a focus on incorporating stakeholder feedback and values into decision making processes, the

'human dimensions' perspective offers a promising approach to promoting regionally-aware dietary change, which may benefit nutrition professionals.

The coupling of agriculture and human health to achieve sustainable population growth and development dates back to the 1930s. Yet, the Food and Agricultural Organization (FAO) only just **defined sustainable diets in 2010** as diets with "low environmental impacts which contribute...to healthy life for present and future generations...[and] are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy." Widespread dietary change presents a unique opportunity to meet multiple Sustainable Development Goals (SDGs).



Non-governmental organizations (NGOs) have **listed choosing a plant rich diet as one of the most important behaviors** the public can partake in to curb greenhouse gas (GHG) emissions. **Meta-analyses** also demonstrate that long-term consumption of red and processed meats are associated with an increased risk of cardiovascular disease, type 2 diabetes, and mortality. The **Mediterranean Diet** is one diet that has been **repeatedly associated with good health**. The diet is characterized as rich in fruits, vegetables, legumes and complex carbohydrates, but low in red meats. Although the Mediterranean Diet is used as a model, any plant-forward diet will confer similar benefits. A shift in consumption from foods that are typically associated with the western diet (e.g. processed foods and meat) to foods that are native to the region (e.g. local crops and agriculture), is a more realistic and appropriate goal for large-scale change. Although global dietary changes are hard to achieve, shifts in consumption patterns that are regionally and culturally specific may assist in the achievement of the goals set out by the SDGs and public health organizations.

Previous nutrition policies implemented in the United States have not proven effective because they did not fully consider the consumer values and attitudes that drive consumer behavior. For instance, the Affordable Care Act (Public Law 111-148) mandated that chain restaurants with at least 20 locations must display caloric content on their menus. Both public health professionals and policy makers argued that **labeling would reduce obesity rates by informing consumers** and help them make healthier food choices. Unfortunately, these changes were not as successful as hoped in curbing the restaurant contribution to obesity due to an overarching

value placed on 'calories per dollar' that was not identified before policy implementation. There was **little to no effect of labeling** on calories ordered across heterogeneous diner samples. Clearly consumer awareness and information dissemination are not adequate to motivate behavior change, indicating a need for new approaches. How then can we help drive shifts toward sustainable healthy diets?

Public health nutrition strategies have typically relied on the distribution of information, despite their lack of efficacy. Such strategies include nutrition labels, dietary guidelines, public health campaigns, and the promotion of various restrictive diets (i.e. vegetarianism, veganism and keto). However, consumer choice is influenced by many competing factors including taste, price, convenience, and accessibility, which are often not addressed within information distribution strategies. These considerations are also known as values. **Values are shaped over the life-course** by personal factors, relationships, resources, and ideals.

These complexities of choice highlight the importance of considering human values in addition to nutritional and ecological principles when crafting policies of public health and nutrition sustainability. To achieve this requires collaboration among professionals from various fields, including environmental scientists, sociologists, nutritionists, psychologists, political scientists, and agricultural economists. At the core of this collaboration should be a focus on the 'human dimensions' of nutrition and natural resources.

The term 'human dimensions' is derived from the field, Human Dimensions of Natural Resources

(HDNR), which can be applied to the study of sustainable diets and nutrition. Despite many variations on the definition of HDNR, most include three important concepts: multidimensionality, reciprocal relationships, and systematic levels. The concept of multidimensionality lends to the interdisciplinary focus of the field. HDNR was developed with the intent of encouraging collaboration across professionals in various fields, a critical strategy also needed to achieve sustainable dietary changes. Additionally, when we deal with natural resources in the food system (i.e. land and water), we must inherently consider the effects that humans have on natural resources and vice versa. Consumer demand for food products drives their production, yet production and supply drive food prices and therefore consumer choice. This is what we call a reciprocal relationship. HDNR considers multiple levels of interaction, which include individual, community, and institutional levels. A major contributing factor to the complexity of food systems is their multi-level makeup, with impacts on (and from) individuals, communities, institutions, large and small farmers, and more. Applying the field of HDNR to the study of dietary behavior has the potential to drive large-scale change.

No single solution exists for the diet-related human health and environmental challenges we face. However, it is clear that a new approach is needed. I propose that we address dietary changes and nutrition policies through the lens of human dimensions. A combination of collaborative and multi-level actions will be needed, paired with context specific solutions to account for the unique challenges and food cultures, dietary preferences and institutional structures present in each community.

So, You Think You Want to be a Scientist?

By Cat Lowry

So, you think you want to be a scientist? That's awesome!

But what does a scientist really do? What if your upper-level science classes are really tough, or you just don't want to stay in school until you're 30 to get a PhD? Maybe you're interested in science, but also have a yearning to be a physician. Or, maybe you have no idea what you want to do but you know you love science. Fear not—there is something for you in the field of science! There are many aspects to the term “science.” The term “scientist” encompasses so many different things. You can be a scientist who works from home, you can be a scientist who takes care of people, or you can be a scientist who doesn't deal with people at all!. Many people think that being a researcher or a private investigator (PI) is the only way to be a “real” scientist. However, there are tons of different jobs and careers in science! As science grows, so does the multitude of job opportunities in the field.

We interviewed three people who work in science at different levels, and none of them happen to be PIs! You will hear from an emergency medicine doctor, undergraduate intern, and lab manager about the different ways they work in science.

Tell us about you and how you work in science.

Madeline Deklava: I am an undergrad getting my Bachelor of Science in health and exercise science and have always really loved science. I also love the people aspect. What I do now

working in research operations is lots of clinical I work and I help other people and labs do their research. I also do performance health analyses for people to give them statistics about their health that they can then take to their doctors.

David Thomson, MD: I was a chemistry major at Wabash College, then went to graduate school at the Human Performance Lab at Ball State University. I did cardiac rehab for a while, then went to medical school at the University of Cincinnati. I did a residency in emergency medicine at the University of Pittsburgh. Since then I have practiced emergency and EMS medicine in several areas. Before coming to CSU I was a clinical professor of emergency medicine and I was the medical director for the EastCare air ambulance program at East Carolina University. I also have a public administration degree from Syracuse University, specializing in healthcare management and policy. Although I have done some research, most of my work before coming to CSU was teaching medical students, residents, flight nurses, and flight paramedics. That's primarily teaching applied principles of science.

Ellen Lyon, MS: I've always loved movement, whether it be running track, volleying a tennis ball, or doing some morning stretches, and I decided I wanted to make a career of it. I studied exercise science in my undergrad and went to study clinical exercise physiology in graduate school. Now, I'm a research associate and the lab manager of the Sleep and Metabolism

Laboratory. I conduct and manage the day-to-day happenings of our research studies. A big part of what I do in the Sleep and Metabolism Lab is helping everything run as smoothly and efficiently as possible. I love organizing and creating an environment which sets up our lab members for efficient and effective success. If you ever get the chance to see the sleep and metabolism lab, you might notice everything is labeled, color-coded, and organized. When I'm not in the lab, I love getting outside and exploring Colorado with my husband and two (very cute) dogs!

Did you always want to work in science? What is your favorite part of working in science?

Madeline: I did always want to work in science. I think my favorite part of working in science is the people. Everyone is always learning and growing and there's always more information. I want to be in an environment where people are wanting to grow in their knowledge and work to improve things.

Dr. Thomson: I've always enjoyed learning, but not just science. Doing emergency medicine allowed me to use the "hard" sciences like chemistry and physiology, but, because I was working with people, I also got to employ some of the "softer" disciplines, like ethics, leadership, and management. I enjoy the experience of sharing some of this knowledge with my clients, patients, and students.

Ellen: I've been aiming for a science-based career since high school. I thought my path would be more healthcare focused by becoming a physical therapist but was quickly weeded out of the hard-science track—I said no thank you to organic chemistry! I knew I loved working with people, sharing new concepts I was learning in

school like how our body works, and living a movement-filled life. During my early college days, I figured out that having an active lifestyle myself helped me feel good! I wanted to share that feeling and together, those interests led me to the exercise science world. Funnily enough, I didn't think of it as "science career" until grad school when I had to organize, execute, and write my thesis. Those core concepts that brought me initially to the field are what I still appreciate most about my job today!

As someone in science, what gets you the most excited?

Madeline: It gets me excited when I explain a key concept, like VO2 max, to someone and it really clicks for them, and they get excited about it. When they get excited about their own data and understand it, I think it's really cool!

Dr. Thomson: I really enjoy solving problems, especially when I can take something from one discipline and use it in another area to create a novel solution. One of the things I most enjoyed about working in EMS and air ambulance services was taking principles from aviation, like human factors analysis, and applying them in medical care. Now I get to take some of the things I learned from working in EMS and apply it to helping firefighters and other "tactical athletes."

Ellen: What gets me most excited in science is the real-life application of it. Most of us in clinical research have the overall goal of improving someone's life in one way or another. When I tell someone I do sleep and metabolism research it typically segues into a relatable conversation that involves them sharing a personal experience in which they connect with me. Maybe they'll even ask me for advice for how to

improve their own experience with sleep or their metabolism. Although I'm not a clinician offering treatment, it opens the door for me to share what we are looking into and how it might be able to help people in the future based on our findings.

Take us through “a day in the life.” Are you lighting things on fire in the lab? Running crazy experiments? Brainstorming how to cure cancer?

Madeline: A lot of times my days are a good mix of things. I'll come in and help with studies—I might do some blood draws in morning and then conduct exercise tests in afternoon. In between scheduled things for the day I might do research for up and coming studies, work with the performance health analysis data, or advertise for performance health analysis.

Dr. Thomson: Working in a lab is very different environment than the world of emergency medicine and EMS that I used to work in. In that world no two days are alike. Much of my work involves supervising stress tests and interpreting the results of those tests. I also support other researchers in the Department of Health and Exercise Science. They are the ones who run the crazy experiments and look for cures. I provide a medical perspective which I hope helps them make important scientific discoveries.

Ellen: As I like to remind new lab members, clinical research can ebb and flow with its daily activities. Some days are crazy; our lab will be in the midst of a 5-day in-laboratory stay and I'll be running around starting an intravenous catheter,

processing blood samples, preparing a research meal, assisting with a muscle biopsy, monitoring polysomnography, and instructing a lab member how to perform a procedure...juggling so many different tasks at once and sometimes doing it all in the middle of the night! Other days are spent in a more mellow mode consisting of sitting in front of my computer organizing data, calling and scheduling potential research participants, submitting a new protocol to the Institutional Review Board, or listening to a podcast about the latest managerial advice. I love how every day is different and my position has such a variety of tasks!

What is the most difficult part of your job, or something you did not realize would take so much of your time?

Madeline: There's lots of admin work in every job, including this one! I spend lots of time working on things such as logistics, working on computer tasks and organizing things. I do enjoy it, but there's definitely more than I thought there'd be.

Dr. Thomson: The most difficult part of being a physician is delivering bad news. In the emergency department or on an ambulance I frequently had to tell patients they had cancer, or tell a family member that their loved one was dead. While I haven't had to break that sort of bad news in the HPCRL, it's still tough when you have to tell someone that the tests suggest they might have heart disease, and we don't think it's safe for them to go back to work until they get that checked out in more detail.

Ellen: Some people who work in clinical human research might say it's the people (research participants) that are the biggest challenge of our work. Although I have found that to be true in some cases, I have learned that everyone has their own reasoning and are going to do what they're going to do. I can't fault someone for that, I can just enjoy the time I have getting to know them and try to make their clinical research experience with me as positive as possible.

What is the best way for curious students to become involved? Take an O-chem class? Be a research participant?

Madeline: Definitely volunteering to be a research participant is a really cool way to get an inside look. I've found too that anyone running a study is going to want to talk about their research, and it's a great way to get to learn. Also volunteering in labs! There's a lot of great opportunities to volunteer in labs!

Dr. Thomson: I think the best thing for students to do is to find something that really fires up their imagination. If it's organic chemistry, that's great, since that's required by a lot of graduate and professional schools. But I've had physician colleagues who had majored in Chinese, or religion, or engineering. Find something you enjoy, and you will do it well. Participating in research, whether as a lab assistant or as a subject is always a good thing to do as a student. Seeing how research is really done can be much more interesting than reading a bunch of papers or a text.

Ellen: I believe that participating in research is the easiest way to get a feel for how research works. Not only is it interesting, it's lovely for me to be able to say "when I had this done, here was how it went". I think adding that personal experience when being the researcher makes a participant feel more comfortable and willing to contribute to the work being done.

Anything else you want to add?

Dr. Thomson: If students have questions about medicine, or getting into professional schools, I'm available to chat. I don't have office hours, so sending an email is the best way to get in touch. You can email Dr. Thomson at: david.thomson@colostate.edu.

Ellen: Don't let the hard science classes get in the way of getting involved in science! There are so many different positions and careers in which you don't need the best grades or complete understanding of complex scientific processes to contribute to the work being done.

As you can see, there are many ways in which one can work in science. However, do not feel limited to the academic side of science. There are thousands of job opportunities in industry, as well as medical science liaison positions, science writing positions, and [more](#). The coronavirus pandemic has increased the demand for many different jobs, including jobs in science. These jobs are in high demand, and according to [new data](#) from the Bureau of Labor, science and math jobs are expected to continue to surge over the next ten years!

If science is something you enjoy, or a career in science sounds enticing, consider getting involved by being a research participant or volunteering in a lab of your choice. If you aren't sure about committing to volunteer or if you'll like working in a lab, consider reaching out to members of the lab or the lab's senior investigator to set up a meeting or interview. Most labs are open to shadowing, as well! Whatever you do, make sure it's something you love and you find exciting. Whether you're into fashion design, metabolism, or engineering, there is something in science out there for you!

SCIENTISTS



**what my mom
thinks I do**



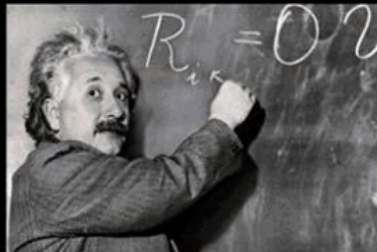
**what my friends
think I do**



**what society
thinks I do**



**what my boss
thinks I do**



**what I think
I do**



**What I really
do**

Contributors



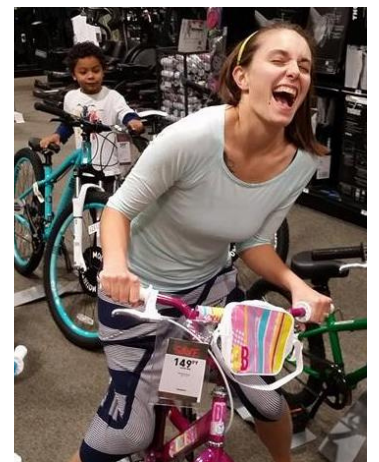
Jenna Bensko is a second year Master's Student in Food Science and Human Nutrition. She is currently working on several projects which investigate the influence of values on consumer ordering behavior at restaurants. In the future, Jenna hopes to contribute to the growing field of sustainable nutrition. Outside of the lab, she enjoys running trails and playing tug-of-war with her dog.

Taru Dutt is a Research Scientist who's work focuses on investigating the mechanisms underlying the induction and regulation of host-mediated immune responses to infectious pathogens (with a particular emphasis on tuberculosis). Research is Taru's passion, and she spends most of her time in the lab, but when she's not there, you can find her in a coffee shop or in a park reading a science/history book or painting.



Jen Felker is a second-year medical student at the University of Colorado School of Medicine at Colorado State University. When she's not doing endless amounts of flashcards, she enjoys spending time with her husband and two fluffy dogs. Jen is passionate about exploring the grey areas of medicine in hopes of improving quality of care outcomes.

Jessica Hill is a postdoctoral researcher in the Nishimura lab with in the department of Biochemistry and Molecular Biology. She works with the model organism *Caenorhabditis elegans* to study host-microbe interactions with in the intestine. At her leisure, Jessica likes to spend time outside with her family.





Cat Lowry is a second-year graduate student studying sleep and metabolism. When Cat isn't working in the sleep lab, she loves adventuring and getting outside. Cat also does gymnastics on top of horses (better known as equestrian vaulting) and has competed all over the world!

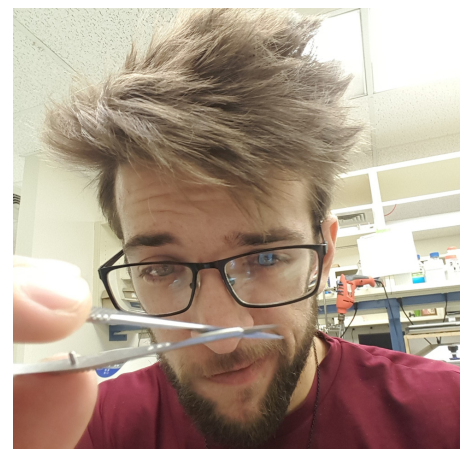
Martin Maxwell is a second year medical student at the University of Colorado School of Medicine at Colorado State University. His interests include person-centered medicine and mental health education. When he's not studying for exams he's spending time with his wife, eating avocado toast, and drinking plenty of lattes



Raj Trikha graduated with his Master's of Science in Human Nutrition in May of 2020. He is currently a 2nd year medical student at the University of Colorado School of Medicine at Colorado State University with aspirations of working in primary care. His goal is to communicate the science of health care to as wide an audience as will listen.



Luke Whitcomb received his Master's degree in Biomedical Science, researching metabolic dysfunction in heart and muscle cells. His interests lie in reducing the burden of chronic disease and combating health care inequity - as well as understanding how those two are linked. He plans to go on to medical school to pursue physician training, medical research and leadership in health care policy reform. In his free time, he enjoys black coffee, quirky podcasts and fast longboards.



FALL 2022



ISSUE 7

Photograph by Luke Treat