Microbes, Mood, and Misconduct

The Emerging Gut-Brain-Legal Axis

Redefining culpability in the age of the Holobiont

Open Access Perspective

Crime and Nourishment: A Narrative Review Examining Ultra-Processed Foods, Brain, and Behavior

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Abstract

Recently, there has been increased scientific and clinical interest in the potential harms associated with ultra-processed foods, including poor mental health, aggression, and antisocial behavior. Research spanning epidemiology, mechanistic pre-clinical work, addiction science, microbiome and exposome science, and human intervention trials has underscored that nutrition is of relevance along the criminal justice continuum. As such, the emerging dietetics research is salient to the thousands of international psychologists and allied mental health

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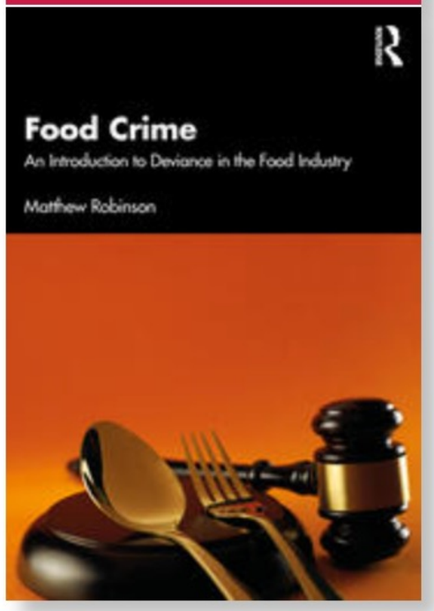

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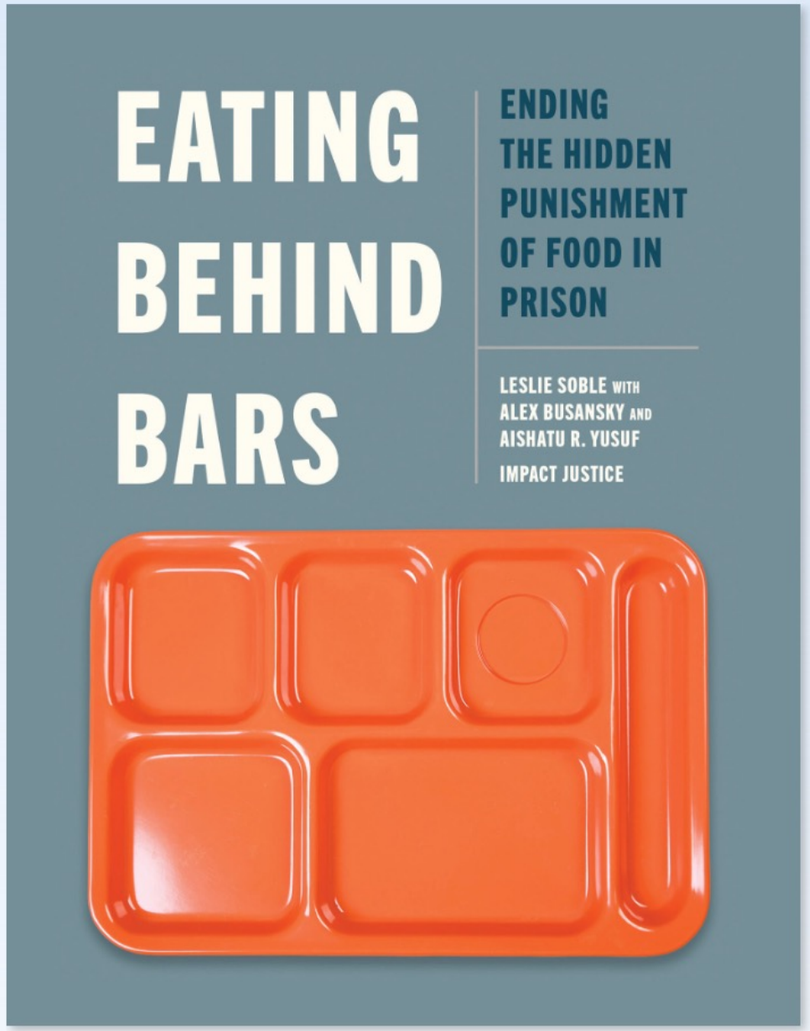

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OPINION | Open Access

The Legalome: Microbiology, Omics and Criminal Justice

Alan C. Logan, Pragya Mishra, Susan L. Prescott

First published: 12 March 2025 | https://doi.org/10.1111/1751-7915.70129 | Citations: 5

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Center for Justice and Mental Well-Being

Catalyzing transformative new approaches to health, justice, dignity, and healing for individuals, communities, and the planet

“Justice at its best is love correcting everything that stands against love.”
— Dr. Martin Luther King, Jr.

The Center for Justice and Mental Well-Being at the Nova Institute for Health is a visionary, transdisciplinary initiative grounded in the recognition that justice—in all its forms—is foundational to human flourishing and mental well-being. From social, economic, racial, and criminal justice, to food, climate, environmental, epistemic, and organizational justice, our work is rooted in the understanding that mental health cannot be separated from the conditions in which people live, grow, and relate to one another.

In a time marked by a global mental health crisis, widespread loneliness, and grotesque injustices occurring in plain sight, the Center addresses the urgent need to explore and address the deeper systemic drivers of suffering, and barriers to flourishing. We bring together scientific inquiry, contemplative wisdom, and integrative health approaches to foster healing, connection, and structural change with a whole-of-society approach.

Through an all-systems lens, we draw on diverse expertise and lived experience to support research, dialogue, and community-based initiatives that challenge injustice and promote inner transformation. By co-creating platforms for collaboration, storytelling, and shared learning, we aim to inspire humility, compassion, and collective action—and move us toward a more just and flourishing world for all.

Alan C. Logan, MSc, ND, Center Director

Alan C. Logan is an award-winning author and internationally recognized scholar with undergraduate and graduate degrees in criminal justice and forensic psychology. He has authored more than 100 peer-reviewed publications in diverse scientific and medical journals, with his work cited over 7,000 times on Google Scholar. His research focuses on the biopsychosocial determinants of mental health and behavior, and their intersections with criminal justice involvement.

The Paradigm Shift

Welcome to the Legalome

We stand at the revolutionary intersection of at least five fields: microbiome science, nutrition science, neuroscience, -omics, and criminal law. What emerges is a fundamental challenge to our understanding of free will, moral responsibility, and justice itself.

The "Holobiont" Revolution

The human body hosts approximately 38 trillion microbial cells—outnumbering our own cells. These microscopic passengers aren't passive inhabitants; they're active co-creators of our biology, neurochemistry, and potentially our behavior.

The Traditional View

The unencumbered self: purely psychological, autonomous, and individually responsible

The Biological Self

Environmentally and microbially influenced, shaped by invisible passengers within

> **Critical Question:** If our microbes influence our thoughts and actions, where does "free will" end and biology begin?

History Lesson: The "Bacillus Criminalis" Myth

The Early 20th Century Mistake

Newspapers ridiculed the notion of a "germ of crime"—a mythical *Bacillus criminalis*. Critics feared biological theories would erase moral responsibility and enable determinism.

The Modern Correction

Today's science begins to vindicate some of the core insight: while there's no single "crime germ," microbial dysbiosis—an imbalance in gut communities—represents a valid, modifiable risk factor for behavioral disturbances.

From ridicule to reality: omics technologies are revealing the biological foundations of behavior.

Introducing "The Legalome"

A groundbreaking framework coined by Alan C. Logan and Susan Prescott merges cutting-edge biological sciences with the courtroom.

Foundation

Application of microbiome and omics sciences to forensic contexts

Translation

Converting biological data—metabolites, microbial signatures—into legally actionable evidence

Application

Informing mitigation arguments, sentencing decisions, and competency evaluations

The Evidence Framework

How do we avoid "junk science" while embracing legitimate biological insights? Mishra, Logan, and Prescott propose a two-tier evidentiary structure:

1

Tier 1: Identification

Using microbiome signatures like fingerprints—forensic identification to place suspects at crime scenes through microbial traces left behind.

2

Tier 2: Contextual & Causal

Explaining behavior or mental state through microbiome data. Example: "My gut microbes intoxicated me" or "Dysbiosis impaired my impulse control."

Hard Question: Can we make the informed claim that microbes can alter the mind and therefore bear on culpability?

BIOTECHNOLOGY AND HEALTH

Your gut microbes might encourage criminal behavior

Is “My microbes made me do it” a valid legal defense?

By Jessica Hamzelou

May 9, 2025

The Myth of the "Normative Brain"

The Legal Fiction

Criminal law assumes a "reasonable person" standard—a mythical individual with a properly functioning, normative brain operating under typical biological conditions.

The Biological Reality

Environmental insults—poor diet, chronic stress, pollution, antibiotic overuse—create profound biological disparities that courts systematically ignore.

> **The Core Argument:** You cannot judge a dysbiotic brain by the standards of a eubiotic (healthy) brain. Justice requires acknowledging biological inequality.

Case Study: Auto-Brewery Syndrome

“But I didn’t have any booze ….”

Auto-Brewery Syndrome

The Trojan Horse

A rare but profound condition where gut microbes transform dietary carbohydrates into intoxicating levels of ethanol—without a single sip of alcohol.

The Culprits

Gut fungi (*Saccharomyces*) or bacteria (*Klebsiella pneumoniae*) fermenting carbs into alcohol

Legal Breakthrough

The first microbiome condition to successfully breach criminal justice walls, forcing courts to accept "microbial agency"

Why "Trojan Horse"? It smuggles biological causation into a legal system built on psychological free will.

The Mechanism of Endogenous Intoxication

The Fuel

Ultra-processed carbohydrates: refined sugars, white flour, high-glycemic foods

The Engine

Dysbiotic overgrowth of fermenting microbes in gut environment

Liver Processing

Ethanol enters bloodstream, overwhelming normal metabolic capacity

Intoxication

Blood Alcohol Content reaches 0.20-0.30%—lethal levels, generated internally

Patients report feeling drunk after eating pasta or bread, with BAC levels that would indicate severe alcohol poisoning if consumed through drinking.

Legal Defense: Involuntary Intoxication

The bedrock principle of criminal law: *Actus Reus* (guilty act) requires *Mens Rea* (guilty mind). But what happens when your lunch becomes vodka without your knowledge or consent?

The Doctrine

Involuntary intoxication negates the mental state required for criminal liability—you didn't intend to become impaired.

The Application

Defense attorneys argue defendants lacked knowledge their bodies would ferment food into intoxicants.

The Precedents

Multiple DUI charge dismissals across the US and Europe based on confirmed ABS diagnoses.

Belgian man whose body makes its own alcohol cleared of drunk-driving

Bruges court heard how defendant had condition called auto-brewery syndrome sometimes brought on by intestinal problems

The market square in Bruges. The man with auto-brewery syndrome is employed by a brewery. Photograph: NobleImages/Alamy

A Belgian man has been acquitted of drunk-driving because he has auto-brewery syndrome (ABS), an extremely rare condition whereby the body produces alcohol, his lawyer has said.

Anse Ghesquiere said on Monday that in "another unfortunate coincidence" her client worked at a brewery, but three doctors who independently examined him had confirmed he had ABS.

Belgian media said in the verdict the judge emphasised that the defendant, who was not named in line with local judicial custom, did not experience symptoms of intoxication.

The Bruges police court, which acquitted the man, did not immediately reply to an email requesting comment.

A real life ..

my microbiome made me do it

This is a new area of research called the "legalome"

omics + microbiome


New Publication
NUTRITIONAL CRIMINOLOGY
Why the Emerging Research on Ultra-Processed Food Matters to Health and Justice
Nova Institute for Health
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Neurolaw & the "Legalome"

Huberty vs. McDonanld's

Open Access Viewpoint

Neurolaw: Revisiting *Huberty v. McDonald's* through the Lens of Nutritional Criminology and Food Crime

by Alan C. Logan [1,*], Jeffrey J. Nicholson [2], Stephen J. Schoenthaler [3] and Susan L. Prescott [1,4]

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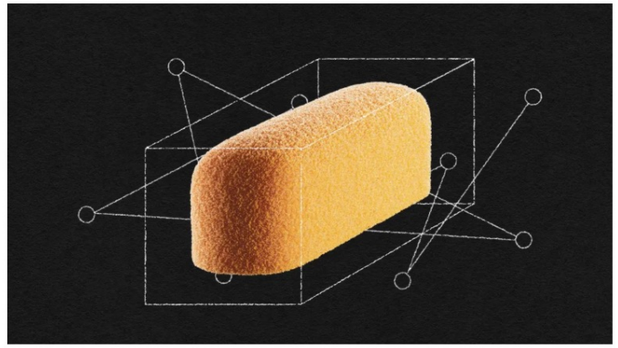
Abstract

Recent studies have illuminated the potential harms associated with ultra-processed foods, including poor mental health, aggression, and antisocial behavior. At the same time, the human gut microbiome has emerged as an important contributor to cognition and behavior, disrupting concepts of the biopsychosocial 'self' and raising questions related to free will. Since the microbiome is undeniably connected to dietary patterns and components, the topics of nutrition and microbes are of heightened interest to neuroscience and psychiatry. Research spanning epidemiology, mechanistic bench science, and human intervention trials has brought legitimacy to nutritional criminology and the idea that nutrition is of relevance to the criminal justice system. The individual and community-level relationships between nutrition and behavior are also salient to torts and the relatively new field of food crime—that which examines the vast harms, including grand-scale non-communicable diseases and behavioral outcomes, caused by the manufacturers, distributors, and marketers of ultra-processed food products. Here in this essay, we will synthesize various strands of research, reflecting this emergent science, using a notable case that straddled both neurolaw and food crime, *Huberty v. McDonald's* (1987). It is our contention that the legalome—microbiome and omics science applied in neurolaw and forensics—will play an increasing role in 21st-century courtroom discourse, policy, and decision-making.

NEUROPSYCH — APRIL 29, 2024

The "Twinkie defense": What we know about diet and crime

In the murder trial of Dan White, the defense touched on diet as a cause for White's actions. It has become known as the "Twinkie defense."



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KEY TAKEAWAYS

● In the 1979 murder trial of Dan White, his legal team seemed to attempt to blame his heinous actions on junk-food consumption. The press dubbed the tactic, the "Twinkie defense." ● While no single crime can be blamed on diet, researchers have shown that providing inmates with healthy foods can reduce aggression, infractions, and anti-social behavior. ● Various studies have demonstrated that consuming nutritious, whole foods rather than processed, high-fat, high-sugar foods improves mental health, mood, and academic outcomes. All heavily factor into one's likelihood of committing crime.

Listen to this article

Frankly …

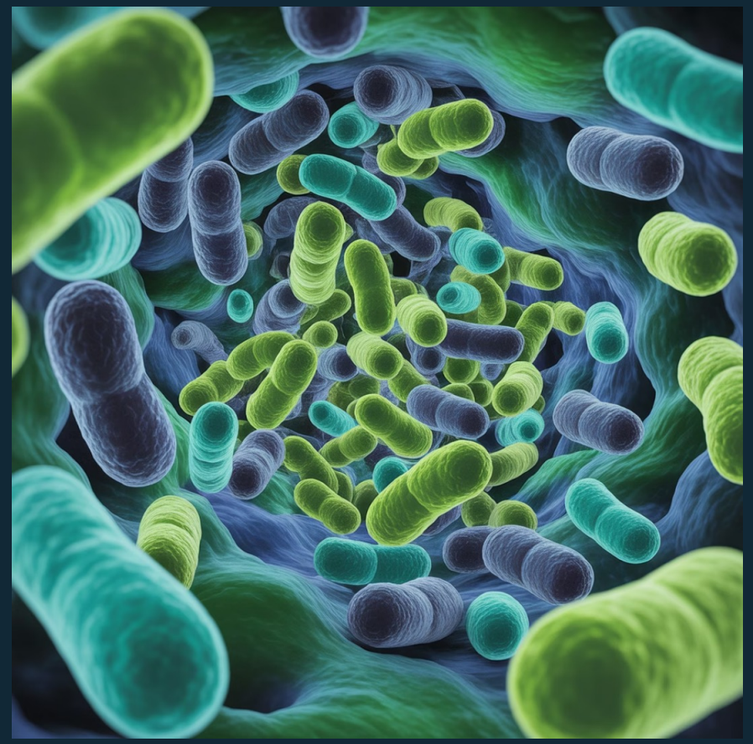
This is JUST THE BEGINNING

Beyond Alcohol: The "Auto-Rage" Hypothesis

If microbes can synthesize ethanol—a known neurotoxin—what other psychoactive compounds might they produce?

The Expanding Metabolite Catalog

- **Propionic acid:** Linked to anxiety and repetitive behaviors in animal models
- **p-Cresol:** Associated with brain fog and cognitive impairment
- **Ammonia:** Neurotoxic at elevated levels, causing irritability and confusion
- **D-lactate:** Can cause metabolic acidosis and neurological symptoms



The Future Defense

Moving from "Auto-Brewery Syndrome" to "Microbial Mood Disorder" or "Auto-Aggression Syndrome" as legitimate mitigation in assault cases.

Iatrogenic Origins? The Antibiotic Trigger

The irony of modern medicine: the very drugs meant to heal may inadvertently create real dysboisis conditions in the gut and may come to influence one's actions.

The Cascade

Heavy antibiotic use can decimate gut microbial diversity, eliminating beneficial species that normally prevent pathogenic overgrowth.

The Vacuum

Opportunistic fermenting organisms colonize the depleted gut landscape without competition or natural checks.

The Implication - while simple has traction

Medical history becomes forensic evidence: Did a prescription to cure an infection contribute to the defendant's dysbiosis and subsequent criminal behavior?

> This raises profound questions about shared responsibility in the medical-legal system.

Nutritional Criminology

When Food Becomes Evidence

An emerging discipline examining how diet and nutrition influence antisocial behavior and justice system involvement.

The Criminogenic Environment

Modern ultra-processed food systems create biological states that systematically reduce impulse control and emotional regulation across populations.

The Evidence Base

Decades of research reported by Logan, Prescott, Schoenthaler, and others document causal links between nutrition and behavior.

The Legal Question

If environment shapes biology, and biology shapes behavior, how do we fairly assign moral culpability?

Food Crime: A Systemic Perspective

"Food Crime" transcends individual dietary choices—it describes systemic harms embedded in how ultra-processed foods (UPFs) are produced, marketed, and distributed.

Production

UPFs engineered for hyper-palatability, not nutrition, prioritizing profit over public health

Dysbiosis

These foods systematically damage gut microbiome composition and diversity

Neurological Impact

Dysbiosis triggers neuroinflammation and alters brain chemistry

Behavioral Consequences

Compromised executive function and impulse control increase antisocial behavior

Corporate Culpability: Does the ultra-processed food industry share responsibility for the mental health crisis observable in prisons nationwide?

Case Study: Huberty v. McDonald's (1987)

The Tragedy

The San Ysidro McDonald's massacre: James Huberty killed 21 people in a seemingly inexplicable rampage of violence.

The Novel Lawsuit

Huberty's widow sued McDonald's and his former employer, advancing a then-radical theory: environmental toxins and dietary excitotoxins had driven him to madness.

The Claim

A "disordered mind" resulted from:

- Heavy metal exposure from occupational welding
- Dietary excitotoxins, particularly MSG in McDonald's Chicken McNuggets
- The synergistic neurotoxic effects of these combined exposures

The Huberty Evidence: Then vs. Now

1987 Findings

Post-mortem hair analysis revealed shocking contamination: Cadmium at 30× normal levels, Lead at 8.4× normal levels

1

The Verdict

2

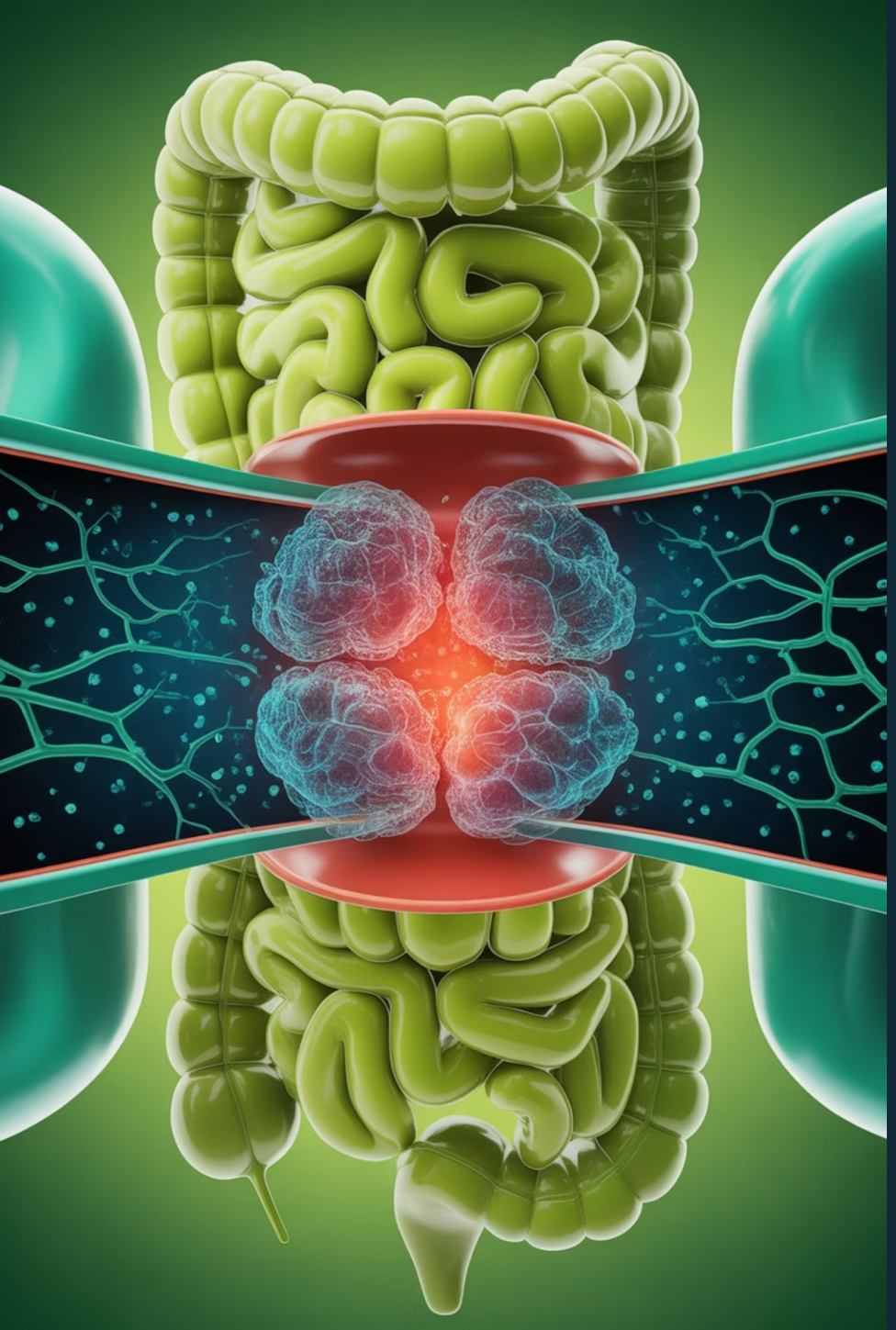
Case dismissed "for want of knowledge"—the science connecting these exposures to violent behavior wasn't mature enough for court

2025 Re-evaluation

Modern research confirms both Cadmium and Lead induce neurotoxicity *and* gut dysbiosis—exactly what the plaintiff alleged

3

> **The science has caught up to the theory.** What was dismissed as speculative in 1987 is now being supported by emerging rigorous mechanistic research.



The "Multi-Hit" Hypothesis

Huberty's case exemplifies how multiple biological insults interact synergistically to produce catastrophic outcomes.

1

Hit #1: Leaky Gut

Ultra-processed foods compromise intestinal barrier integrity

2

Hit #2: Toxin Entry

Heavy metals bypass weakened gut defenses, entering bloodstream at elevated levels

3

Hit #3: Leaky Brain

Compromised blood-brain barrier allows neurotoxins direct access to neural tissue

4

Outcome

Neuroinflammation, oxidative stress, and behavioral dysregulation

The Lesson: Nutritional Criminology examines interactions among diet, environment, and microbiome—not isolated factors.

Dysbiotic Drift

The Gradual Shift

Over recent generations, human gut microbiomes have drifted progressively away from ancestral states, losing diversity and beneficial species.

The Definition

Gradual population-wide shift of gut microbiomes away from ancestral compositions due to westernized diets, antibiotics, and sanitation

The Consequence

Loss of microbial diversity correlates with rising societal rates of impulse control disorders, aggression, and mood disturbances

> As our microbiomes have changed, so have our collective mental health outcomes

Mechanisms of the Gut-Brain-Aggression Axis

Three primary biological pathways connect gut dysbiosis to aggressive behavior, each supported by extensive mechanistic research.

1

Neurochemical Pathway

Gut bacteria synthesize or regulate neurotransmitters: Serotonin (mood stabilization), GABA (anxiety reduction), Dopamine (reward processing). Dysbiosis disrupts this production.

2

Immune-Inflammatory Pathway

Dysbiosis triggers systemic inflammation, releasing cytokines that cross the blood-brain barrier, causing neuroinflammation strongly linked to aggression and impulsivity.

3

Vagal Signaling Pathway

The vagus nerve provides direct bidirectional communication between gut and brain. Microbial metabolites signal via this nerve, influencing emotional regulation and stress responses.

Animal Evidence: The FMT Study

Uzan-Yulzari et al. (2024) conducted a landmark experiment demonstrating causal relationships between microbiome composition and aggression.

The Method

Fecal Microbiota Transplant (FMT) from antibiotic-exposed human infants into germ-free mice, creating controlled microbiome conditions.

The Result

Mice receiving the "antibiotic-disrupted" microbiome exhibited significantly elevated aggressive behaviors compared to controls receiving healthy microbiomes.

The points to causation.

The Serotonin Connection

The mechanistic breakthrough: identifying the specific neurochemical pathway linking dysbiosis to aggression.

01

Microbiome Disruption

Antibiotic exposure creates lasting dysbiosis

02

Depleted Serotonin

Aggressive mice showed significantly reduced brain serotonin levels

03

Behavioral Changes

Low serotonin directly correlated with increased aggressive attacks

04

Causality Established

Microbes (not just genes) regulate the neurochemistry underlying violence

Significance: This demonstrates microbiome composition can directly alter brain chemistry and behavior—a finding with profound legal implications.

Human Evidence: The Czech Prison Study

Langmajerová et al. (2025) provided the first direct human evidence linking microbiome signatures to impulsive violence in a controlled setting.

The Study Design

Female prisoners in Czech Republic facilities: violent offenders compared to non-violent controls

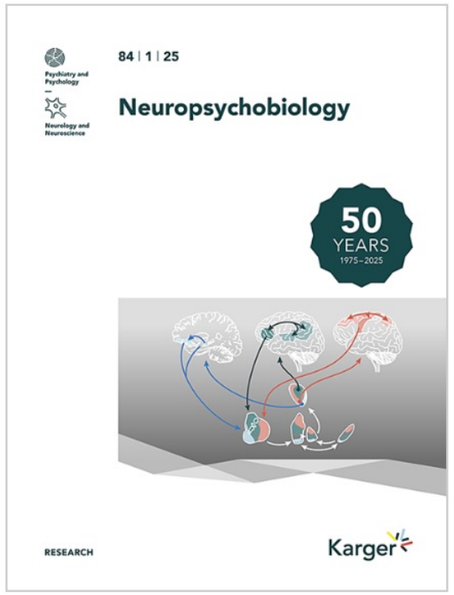
The Strength

Controlled environment—identical prison diet, living conditions, stress levels—isolates microbiome as the variable of interest

The Innovation

Combines behavioral assessments, medical records, and comprehensive metagenomic sequencing of gut microbiomes

February 2025



Gut Microbiome in Impulsively Violent Female Convicts

Subject Area: Neurology and Neuroscience , Psychiatry and Psychology

Michaela Langmajerová; Janet Ježková; Jakub Kreisinger; Jaroslav Semerád; Ivan Titov; Petra Procházková; Tomáš Cajthaml; Václav Jiřička; Jan Vevera; Radka Roubalová

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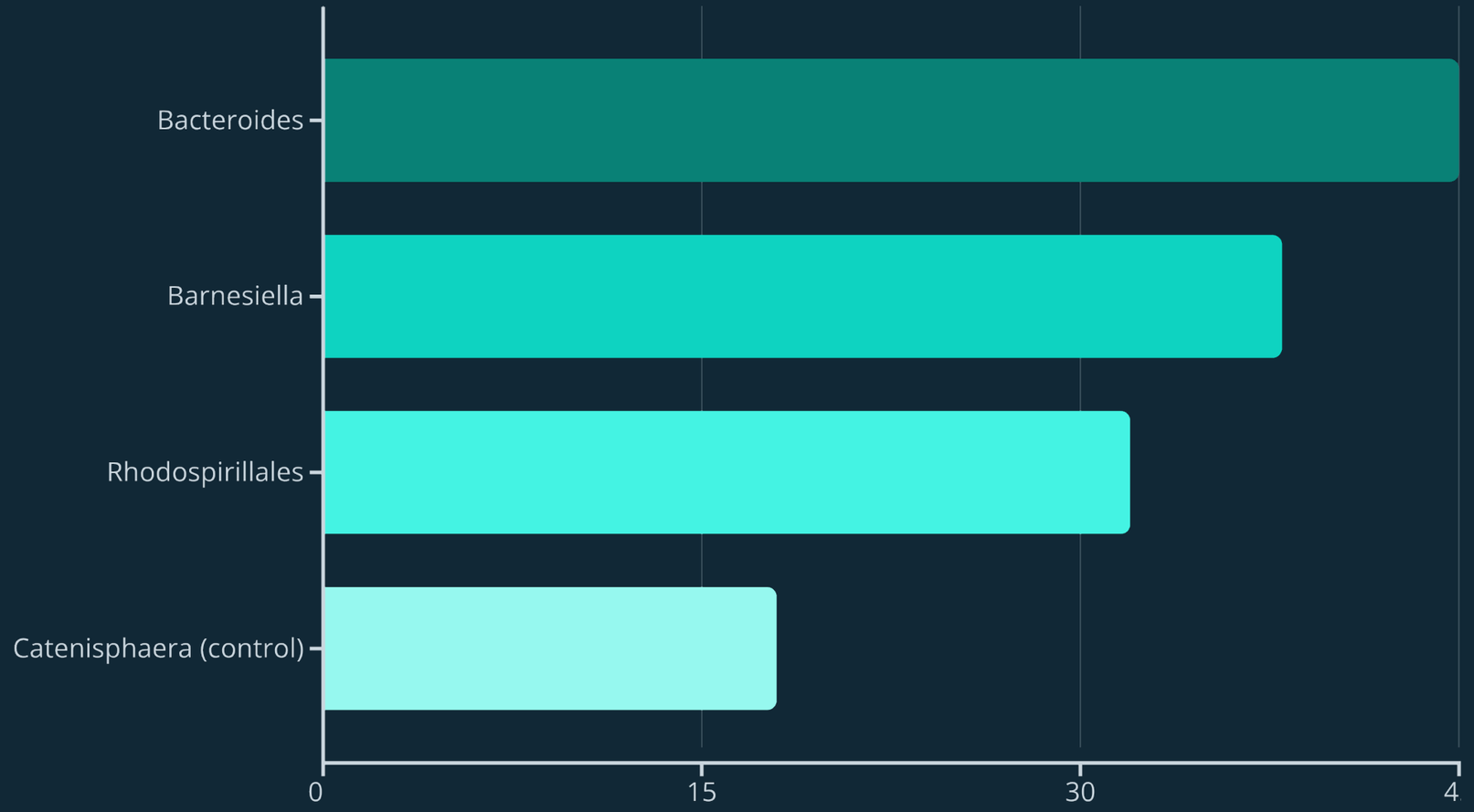
Article Contents

Abstract

Introduction: Impulsivity and aggression are often interlinked behavioral traits that have major implications for our society. Therefore, the study of this phenomenon and derivative interventions that could lead to better control of impulsive aggression are of interest. ***Methods:*** We analyzed the composition and diversity of the gut bacterial microbiome of 33 impulsively violent female convicts with dissocial personality disorder and 20 non-impulsive age-matched women. Further, levels of assorted neurotransmitters and short-chain fatty acids (SCFAs) were analyzed in serum and stool samples. We also assessed all participants using a battery of

The "Microbial Signature" of Violence

The study identified specific bacterial taxa consistently associated with impulsively violent behavior—a potential biomarker for aggression risk.



Violent offenders showed elevated levels of *Bacteroides*, *Barnesiella*, and order *Rhodospirillales*. Non-violent controls had higher *Catenisphaera*—potentially a protective species.

The Tryptophan Trap

The Metabolic Insight

Violent convicts exhibited significantly elevated fecal **Tryptophan** levels compared to controls.

The Paradox

High gut tryptophan should mean abundant serotonin production—but the opposite occurred. Why?

The Interpretation

Dysbiotic bacteria were *hoarding* tryptophan or converting it to alternative metabolites, preventing its normal conversion to brain serotonin.

> High Gut Tryptophan + Low Brain Serotonin = Impulsive Aggression

Short-Chain Fatty Acids as "Brakes"

SCFAs—produced when beneficial bacteria ferment dietary fiber—function as biological regulators of impulse control and emotional regulation.

The Role of Butyrate

Reduces neuroinflammation, strengthens blood-brain barrier integrity, and promotes prefrontal cortex function (executive control)

The Role of Propionate

Modulates immune responses and influences satiety signals that affect mood regulation

The Deficit Crisis

Low-fiber diets—ubiquitous in prisons and food deserts—produce insufficient SCFAs, removing biological "brakes" on aggressive impulses

The Sociobiome

Inequality is Biological

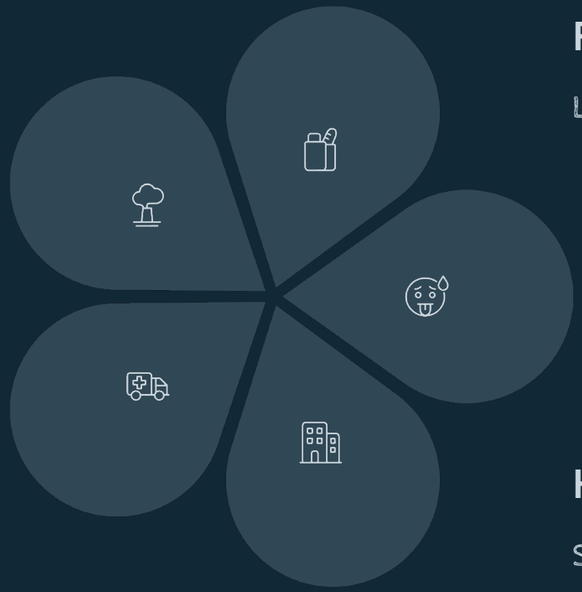
Social determinants of health—poverty, pollution, food insecurity, chronic stress—are inscribed in the microbiome, creating biological disadvantage.

Environmental Toxins

Industrial pollution concentrated in low-income neighborhoods

Healthcare Access

Limited preventive care and higher antibiotic overuse



Food Deserts

Limited access to fresh, fiber-rich whole foods

Chronic Stress

Economic insecurity produces physiological stress responses

Housing Quality

Substandard housing exposes residents to mold and toxins

> **"Your zip code determines your gut code."** The justice gap is, fundamentally, a microbiome gap.

The Occupational Legalome

Correctional Officers: The Overlooked Victims

While research focuses on inmate health, correctional officers endure parallel biological stressors that may compromise their microbiomes and decision-making capacity.

The Occupational Hazards

- Chronic sleep deprivation from shift work
- Constant hypervigilance and psychological stress
- Often consuming the same poor-quality institutional food
- Limited time for exercise and self-care

The Hypothesis

Correctional officers experience "Occupational Dysbiosis" that may impair judgment, increase reactivity, and contribute to excessive force incidents.

Officer wellness is institutional safety.

Stress, Diet, and Officer Safety

Disrupted Circadian Rhythms

Shift work alters gut microbiome composition

Burnout & Reactivity

Increased risk of excessive force and poor judgment

Elevated Stress Hormones

Chronic cortisol damages microbial diversity

Systemic Inflammation

Dysbiosis triggers inflammatory responses

Cognitive Decline

Neuroinflammation impairs decision-making and emotional regulation

Proposal: Nutritional interventions for officers are not just wellness initiatives—they're liability reduction and public safety strategies.

From Punishment to Rehabilitation

If dysbiosis contributes to criminal behavior, microbiome-targeted interventions represent a new frontier in criminal justice reform.

Dietary Reform

Replace ultra-processed foods with fiber-rich whole foods in correctional facilities—the "Public Health Quarantine Model"

Psychobiotics

Administer specific probiotic strains (e.g., *Lactobacillus rhamnosus*) proven to reduce aggression and anxiety in clinical trials

Fecal Microbiota Transplant

Explore FMT as potential therapy for severe impulsive aggression in treatment-resistant cases

Ethical Frontiers & Risks

As we embrace the Legalome, we must navigate profound ethical challenges that could either advance or undermine justice.

Risk #1: Biological Fatalism

We must not resurrect discredited notions of "born criminals" by claiming certain microbiomes predetermine behavior. Dysbiosis is modifiable—not destiny.

Risk #2: Privacy & Surveillance

Who owns your microbiome data? Can the state compel gut testing to predict recidivism? What protections prevent discrimination based on microbial profiles?

Risk #3: The Justice Gap Widens

Will only wealthy defendants afford sophisticated "Legalome defenses" with expert witnesses and comprehensive testing, while poor defendants lack access?

Scientific progress must be accompanied by robust ethical frameworks and equitable access to ensure justice, not just for the privileged few.

Conclusion

Justice Involves the Gut

The Gut-Brain-Legal Axis demands we fundamentally reimagine criminal accountability, moving beyond outdated notions of the autonomous individual toward a more scientifically informed, compassionate justice system.

01

Acknowledge Biological Constraints

Accept that free will operates within biological boundaries shaped by microbiome health

02

Reform Food Crime Environment

Address systemic nutritional injustice as a public health and criminal justice imperative

03

Fund Microbiome-Based Rehabilitation

Invest in research translating biological insights into effective interventions

> **The path forward requires courage:** to challenge legal traditions, to embrace complexity, and to build a justice system that recognizes we are all holobionts—shaped by invisible passengers we never chose, navigating biological circumstances beyond our control.

Citations

The Legalome & Nutritional Criminology

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Our microbiome, justice and mental health are really important

Thank you so much for your attention

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