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EQUINE SCIENCE REVIEW

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College of Agriculture,
Food and Environment

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Equine Science Review is a monthly College of Agriculture, Food and Environment newsletter that highlights important equine work happening at the University of Kentucky.



Photo courtesy Dr. Jimmy Henning.

KOCH'S POSTULATES IN THE 21ST CENTURY

In our recent piece entitled “Getting [the target right – Germ Theory.](#)” the concept of ‘germs’ as causative agents of disease was discussed.

During the Golden Age of Microbiology, spanning the mid-1800s to the start of the Great War in 1914, progress was made in leaps and bounds in the fields of science and medicine, and Germ Theory was born. This progress gave rise to modern concepts of hygiene, reduced mortality for new mothers, practices such as pasteurization and much more. Germ Theory was the foundation for Robert Koch's Postulates of disease. The original postulates were:

1. The microorganism must be found in diseased animals [or humans] but not in healthy animals [or humans].
2. The microorganism can be isolated from a diseased animal [or human].
3. The isolated microorganism will cause disease if introduced into a healthy animal [or human].
4. The microorganism must be able to be reisolated from the inoculated, diseased animal [or human] and identical to the original specific causative microorganism.

In times where we can barely even imagine how few research tools these scientists had at their disposal, the need for rigor was paramount. Medical science was emerging from an era of empirical practices which included treatments with multiple, often spurious, ingredients and archaic practices with little evidence of



MARY MALLON, BETTER KNOWN AS TYPHOID MARY, LEFT, SITS AMONG A GROUP OF INMATES QUARANTINED ON AN ISOLATED ISLAND ON THE LONG ISLAND SOUND. PHOTOGRAPH: SCIENCE HISTORY IMAGES/ALAMY STOCK PHOTO.

efficacy such as bloodletting. Scientific rigor was the New Order.

Koch's postulates represented a central tenant of that new order and an evidence-based approach to medicine. As such, it will come as no surprise that most thinking, modern minds of the time embraced them and the medical profession has held them up as Gold Standards ever since. As brilliant and insightful as Koch's postulates were even Koch himself recognized their shortcomings.

For example, the agent of cholera, *Vibrio cholerae*, a source in intense interest and significant disease at the time, could easily be found in sick patients, but could also be detected in some normal, healthy humans as well. This obviously did

not fulfil postulate #1.

The infamous case of Mary Mallon (1869 - 1938) is another rather sad example. Poor Mallon was an asymptomatic carrier of *Salmonella typhi*, typically the cause of typhoid fever. Working as a cook in the Northeast, she is believed to have infected 53 people with typhoid, of whom three died. It is from her that we get the colloquialism ‘Typhoid Mary.’ If someone talks about Typhoid Mary these days it's often a euphemism for ‘a spreader of disease.’ To prevent Mallon from infecting more people, she was forcibly confined to a quarantine hospital on North Brother Island, New York, for the last 30 years of her life.

Salmonella typhi is a significant



IMAGE: DEPOSIT PHOTOS.

pathogenic bacterium yet Mallon never became sick from it. We cannot specifically answer the question of why in the here and now, but it clearly indicates an interaction between the host and the organism, which in Mallon's case, did not result in disease.

We can frequently detect bacteria considered to be pathogenic in the feces of apparently normal, healthy horses. These include *Salmonella* spp., *Clostridium perfringens* and *Clostridioides difficile* – a veritable Rogue's Gallery of pathogens according to my notes from vet school. Whilst these bacteria could be isolated, administered to another horse and make it sick, thereby fulfilling some of Koch's basic tenants, they don't fulfill all the criteria: most notably because we can find them in healthy horses. The same could be true for bacteria identified from other parts of the horse's body where organisms that can be associated with disease can be found in

the absence of disease. For example, *Streptococcus zooepidemicus* is considered normal flora in the throats of normal horses, but we can identify it as a pure culture in abscesses and in cases of pneumonia, strongly suggesting it is a heavy contributor to disease.

The age of molecular biology and genomic sequencing at first seemed to be overwhelming in the context of identifying causative agents of disease. Nucleic acids such as DNA can be extracted from feces, tissue or liquid samples and generate an abundance of data. Utilizing these data can be challenging because reference genomes to which the genomic sequences were mapped may be woefully inadequate, resulting in yet more questions.

Whilst that is still a thorny obstacle, we are fortunate that great, modern minds continue to forge ahead with these knotty problems. Going forward, relatively inexpensive sequencing options and

the field of bioinformatics offer further insight hitherto unknown in these areas. With diligence, perseverance, and a collaboration between horse owner, veterinarian and research scientist, we can now not only analyze samples from unhealthy horses, but we can realistically compare them to the equivalent sample from large numbers of healthy horses. Knowing what is normal is the age-old question biologists have asked themselves for centuries and is a central principle in a veterinary education.

Nowadays, we have the luxury of assessing cause and effect à la Koch, but we are also acquiring an extraordinary repertoire of in-depth knowledge on a molecular level. Importantly, based on the diligent observations of the great predecessors of medical science, we can expand Koch's Postulates with critical factors such as host effects and interactions, the influence of diet and of environment. When we combine all of these factors, we see a much more sophisticated picture where the harder we look the more detail we see.

| *Emma Adam, DVM, PhD, DACVIM, DACVS is based at the University of Kentucky Gluck Equine Research Center and Veterinary Diagnostic Lab and is responsible for research and veterinary industry liaison. Jackie Smith, MSc, PhD, MACE, Dipl AVES is an epidemiologist based at the University of Kentucky Veterinary Diagnostic Lab.*

NEW PATHOGEN DISCOVERY DIAGNOSTIC LABORATORY UNDER CONSTRUCTION AT UKVDL

The University of Kentucky Veterinary Diagnostic Laboratory is excited to announce the opening of a New Pathogens Discovery Diagnostic Laboratory this fall. The laboratory will serve as an extension to the existing UKVDL Molecular Biology, Virology and Bacteriology laboratories to help identify potential pathogens, both endemic and emerging, that may cause morbidity and mortality in animals.

Pathogen detection will be done using cutting-edge Next Generation Sequencing (NGS) technology, metagenomics and bioinformatics methods. The Gluck Equine Research Center has plans for a similar laboratory, primarily for infectious disease discovery research.

Traditionally, the identification of infectious disease agents in specimens/animals submitted to the UKVDL has been done through microscopic observation (morphology and Gram stain), bacterial media culture, viral cell culture, polymerase chain reaction (PCR) and other traditional diagnostic methods.

Reliable cultivation of bacteria was first done by Louis Pasteur and Robert Koch in the late 19th century, and both were named the Fathers of Microbiology for their contributions.

The first virus (vaccinia) was grown in cell culture in 1913. The PCR method was discovered in 1985 by Kary Mullis, an industrial chemist. Unfortunately, conventional bacterial and viral cultures can take days, weeks and even months to lead to pathogen identification and sometimes grow nothing at all. Unlike culture, PCR can only identify specific agents



PHOTO COURTESY DR. CRAIG CARTER.

that might be suspected.

In 2015, the UKVDL acquired a MALDI-TOF instrument (Matrix-Assisted Laser Desorption/Ionization-Time of Flight) for identification of culturable bacteria and fungi by using mass spectrometry and laser technology. The instrument can identify most agents within minutes, improving the turn-around time by about 24 hours. However, the organism must first be cultured, which still requires about 24 hours or more depending on the microorganism.

The implementation of NGS and leading-edge bioinformatics systems in the new UKVDL laboratory will assist UKVDL pathologists and microbiologists and Gluck scientists in the discovery of new pathogens and identify known pathogens more precisely than traditional methods. It will also enable innovative disease surveillance methods for endemic and emerging animal diseases. Metagenomics is a method to

study organisms that are difficult or impossible to culture, some of which may be potential pathogens. We are happy to announce that Litty Paul, PhD, an experienced investigational biologist, has been recruited to the UKVDL to design and launch the new NGS laboratory.

Tissue samples from sick or deceased animals are sent to a diagnostic laboratory by a veterinarian or an owner curious about the cause (etiology) of an illness or death loss. Once this new method is validated, the laboratory will extract and sequence the genetic material from the samples and store them in databases. The databases will then be analyzed by state-of-the-art bioinformatics software that can identify and classify the community of microorganisms present in the samples, which can aid in disease diagnosis. Even more powerful is the ability to compare analyses from sick and healthy animals to help identify

and characterize new and emerging pathogens.

Several of the 60-member veterinary diagnostics laboratories (VDLs) of the National Animal Health Laboratory Network (NAHLN) are already utilizing this technology.

This past spring, many Bluegrass horse farms were experiencing outbreaks of severe diarrhea in very young foals, and traditional diagnostic tests were not useful in providing the answers. Samples were gathered systematically from many local Thoroughbred farms by Emma Adam, DVM, PhD, DACVIM, DACVS, assistant professor, research and industry liaison at the Gluck Equine Research Center, and brought to the UKVDL for testing in the microbiology laboratory of Erdal Erol, DVM, MSc, PhD, head of diagnostic microbiol-

ogy and professor at the UKVDL. He then forwarded select samples to the Texas A&M VDL and the University of Missouri for electron microscopy (EM) for testing. Both labs identified rotavirus on EM. Oddly, all PCR tests for rotavirus group A run at UKVDL had been negative. Feng Li, DVM, PhD, professor and William Robert Mills Chair in Equine Infectious Disease at the Gluck Center, sent fecal specimens to the South Dakota State University VDL for NGS and metagenomics analysis. This collaborative effort identified a novel group B rotavirus in the foal specimens. Until this time, only group A rotavirus was targeted by the UKVDL PCR test. This is a prime example of the outstanding collaborative diagnostic effort among the UKVDL, Gluck Center and other institutions, and

demonstrates how these new methods can rapidly identify a new, emerging pathogen.

This data enabled Erol and Li to swiftly develop and validate a new PCR that can now identify the new group B rotavirus in about four hours. This test is now offered by UKVDL. The good news is the UKVDL is now prepared to detect the new virus in upcoming foaling seasons.

Once NGS technology is in place at the UKVDL and the Gluck Center, new and emerging pathogens in horses and other animals will be detected faster and easier than ever before.

| Erdal Erol, DVM, MSc, PhD, head of diagnostic microbiology and professor; and Litty Paul, PhD, both from the UK Veterinary Diagnostic Laboratory, provided this information.

EQUINE SCIENCE REVIEW WINS NEWSLETTER CATEGORY AT 2021 AMERICAN HORSE PUBLICATIONS

UK Ag Equine Programs Equine Science Review: Highlighting Research & Outreach Efforts at the University of Kentucky won top honors at the 2021 American Horse Publications' annual media awards competition. The Equine Science Review won in the newsletter business category.

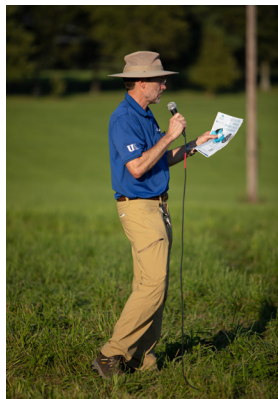
"The content is well-researched and well-written, as would be expected from a university of this caliber. Photo selection and placement effectively highlight key points of each article. Overall, this publication does an excellent job of delivering content appropriate for the target audience and meeting its mission statement," read judges' comments on the submission.



2021 UNIVERSITY OF KENTUCKY EQUINE FARM AND FACILITIES EXPO HELD SEPT. 28



PHOTOS COURTESY MATT BARTON AND SYDNEY CARTER, UK COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT.



The 2021 University of Kentucky Equine Farm and Facilities Expo showcased best practices in equine farm management at the famed Spendthrift Farm in Lexington, Kentucky. UK Cooperative Extension Service and Ag Equine Programs held the annual event Sept. 28, which featured educational talks about farm layout and planning, establishing new pasture and weed spraying options for farms of all sizes. Spendthrift Farm personnel also spoke about engaging non-horsemen in the horse racing industry.

Established in 1937, Spendthrift Farm has been home to top stallions, including 10 Kentucky Derby winners & 2 of the last 4 Triple Crown winners. We are the home to Champion Sire INTO MISCHIEF & 2020 Kentucky Derby winner, AUTHENTIC.

Sponsors for the event included Central Equipment, Derby State Equipment Sales, Farm Credit Mid America, Hallway Feeds, McCauley's, Robert Davis & Sons Hay and Straw, Inc. and Tribute Equine Nutrition. Additional support was provided by Central Kentucky Ag Credit, NTRA Advantage Equine Discounts and The Pond Lady.

| *Holly Wiemers, MA, APR, is the communications and managing director for UK Ag Equine Programs.*

HOW ARE EQUESTRIAN AGE AND SPORT PARTICIPATION RELATED TO SOCIOECONOMIC FACTORS?

United States youth programs such as Pony Club, 4-H, United States Equestrian Federation and youth programs sponsored by breed associations have been proficient at educating about horse health, including the importance of vaccination, nutrition, exercise and fitness, animal safety, diseases and toxicities. Participation in equestrian sport often begins in these youth programs and extends into adulthood. And many horse riders understand that costs associated with participating can be high, but do factors such as age and type of participation relate to socioeconomic status?

University of Kentucky College of Public Health members Kimberly I. Tumlin, PhD, MS, MPH, director of the Equestrian Athlete Initiative and assistant professor, and Steven Claas, medical research writer, and College of Agriculture, Food and Environment member Karin Pekarchik, MS, senior extension associate for distance learning in the Department of Biosystems and Agricultural Engineering and founder of the UK Female Equestrian Health and Wellness Community of Practice, teamed up to find out. A survey seeking to create a profile of equestrian participation nationally was developed based on the National Health and Nutrition Examination Survey for socioeconomic and economic questions. The [Female Equestrian Health and Wellness Network \(FEHWN\)](#) leader, Pekarchik developed and reviewed questions around types of participation in the industry.

Findings for Kentucky equestrians were reported in the [Journal of Extension](#) article. Riders sustain their activity for multiple years and the majority of participants do ride horses. It comes as no surprise to those involved in equestrian sports

that regular participation can be expensive. Perhaps the most surprising finding from this study was that not only do many equestrians spend more on horse-related activities than other avocations, but a significant number of those surveyed said that they spend more than their annual income on equestrian activities yearly. That's an alarming finding, and it potentially points to the need for educational programs to introduce participants to equestrian activities across a range of financial commitments and to include elements that emphasize financial responsibility and wellness.

To advance awareness of these knowledge deficits, the Female Equestrian Health and Wellness Network has started to work with member organizations in the U.S. and abroad to determine what additional research and programming can be done to fill gaps in understanding. This study highlights the need for more research with people who ride and work with horses.

| *Kimberly I. Tumlin, PhD, MS, MPH, is assistant professor, epidemiology, UK College of Public Health research director, Equestrian Athlete Initiative, College of Health Sciences; Karin Pekarchik is senior extension associate for distance learning, UK College of Agriculture, Food and Environment Department of Biosystems and Agricultural Engineering; and Steven Claas is senior research associate, UK College of Public Health.*



IMAGE COURTESY KARIN PEKARCHIK.



IMAGE COURTESY KIMBERLY TUMLIN.

RACECOURSE MANAGERS LEARN WAYS TO MAKE THEIR TRACKS SAFER DURING UK GRADING SCHOOL

In horse racing, safety of the horse and rider is paramount. A University of Kentucky professor and leading racecourse managers recently showed racetrack employees how to improve safety by properly grading the surface.

“The track’s subgrade is the foundation and without a good foundation, you can’t have a good structure, which is your track’s cushion,” said Harrison Young, assistant superintendent at Colonial Downs and grading school participant. “This class is a great opportunity for people like me to learn from people like Mick Peterson and Dennis Moore about practices and methods that can minimize the risk of injuries to horses and riders, through the understanding of the importance of testing, surveying and grading. Safety is our motive, and the more we can learn, the better the industry will be.”

During the three-day UK grading school, entry to mid-level track surface employees learned from Peterson, Alfredo Laureano, superintendent at Keeneland Racecourse and Moore, who is a superintendent of the tracks at Santa Anita, Los Alamitos and Del Mar and a private consultant.

“One of the priorities of this program is getting the up-and-coming racecourse managers experience with some of the more complicated equipment used in the critical roles on the track. One of these critical areas is the grading of the surface,” said Peterson, professor in the UK Department of Biosystems and Agricultural Engineering and director of the Racetrack Safety Program.

Surface grading is vital to keep-



PHOTO BY KATIE PRATT. TO VIEW THE VIDEO, CLICK [HERE](#).

ing horses and riders safe during a race. Grading school participants received one-on-one instruction operating a new grader and an older one. They also learned how to properly grade synthetic and dirt racetracks. All hands-on instruction was at Keeneland.

“You have to keep the hard base underneath the surface consistent, not only because of the impact of the hoof on the ground, but to keep the moisture content consistent,” Peterson said. “You also must have consistent banking in straightaways and the turns so the loading of the legs is even, and when lead changes occur, horses and riders can use the same visual indicators to change lead.”

The industry has a strong interest for educational programs and workforce training centered around safety. The grading school received 15 applications for the five participant spots in this first school.

“The more education we have

and the more knowledge we can learn about the new methods helps allow us to keep horses on the track and to be able to continue horseracing in the safest way that we possibly can,” Young said.

The grading school is the second segment of the Racecourse Manager Certification Program, a joint effort of the National Thoroughbred Racing Association Safety and Integrity Alliance, the UK College of Agriculture, Food and Environment and the Racing Surfaces Testing Laboratory. The first part was on turf courses.

Sign up to receive information about RMCP offerings, including the next Grader School, [here](#). Learn more about the Racecourse Managers Certificate Program [here](#). Enroll in the "Turfgrass as an Equine Sports Surface" course [here](#).

| *Katie Pratt is an agricultural communications specialist in the UK College of Agriculture, Food and Environment.*

IVERMECTIN AND COVID-19

If you have seen stories suggesting the use of ivermectin, a so-called “miracle cure” medication, for COVID-19 — beware.

While the drug can be prescribed in humans to treat various parasites, scabies or highly resistant cases of lice, ivermectin is most commonly used in livestock as an anti-parasitic. There are no proven benefits for its use in treating COVID-19.

Veterinarians often prescribe ivermectin as a de-wormer for livestock, most commonly horses. The drug is used so frequently to treat animals that you can generally find it sold over the counter in feed and pet stores. It is important to note that the dosages intended for use in animals, particularly horses, are much larger than those used in humans. Therefore, a human taking even a single dose of ivermectin which is intended for use in animals could experience dangerous consequences. Some risks associated with high doses of ivermectin include:



- Allergic reactions.
- Serious skin reactions including severe rashes.
- Seizures.
- Cardiovascular issues, including low blood pressure.
- Visual disturbances.

Vaccines remain the safest and most effective preventative measure against COVID-19. They are proven to prevent severe COVID-19 disease, hospitalization and death.

If you are ill with COVID-19 symptoms, you should quarantine yourself and contact your health care provider for further advice. Seek medical attention immediately if your symptoms worsen.

If you live with, or are in close contact with others, wear a mask. You should never attempt to treat COVID-19 with over the counter or veterinary medications or at-home remedies without seeking guidance from your physician or pharmacist.

| *Frank Romanelli, Pharm.D., MPH, FAPhA, BCPS, AAHVP, is Paul F. Parker Endowed Professor of pharmacy and associate dean at the University of Kentucky College of Pharmacy with joint appointments as Associate Professor of Medicine and Associate Professor of Health Sciences. Source: UK Now.*

DO YOU OWN HORSES, PONIES, MULES OR DONKEYS?

We need YOU!

HAY, THERE! Do you have a horse on your property? What about a small herd of ponies? A mule to protect your flock or a donkey for companionship? No matter if you have one or 100, a show mount, work horse or pasture potato, we want to hear from YOU!

Did you know that traditional ag counts, like those done by the USDA, underestimate Kentucky’s equine industry by nearly 50 PERCENT?! The University of Kentucky and the Kentucky Horse Council are looking to fix that problem – and you can help!

Help us protect our unique equine community by providing your contact information [HERE](#) to help us best determine a sampling strategy for the 2022 Kentucky Equine Survey. Every horse owner deserves to be heard!

As always, all information is confidential and will never be shared. Questions? Contact C. Jill Stowe at jill.stowe@uky.edu.

UK IN THE NEWS

RMTC FULLY ACCREDITS UK EQUINE LABORATORY

RMTC's board of directors voted unanimously in favor of accreditation.

The Racing Medication & Testing Consortium announced Sept. 21 that it has granted full laboratory accreditation to the University of Kentucky Equine Analytical Chemistry Laboratory. The RMTC's board of directors voted unanimously in favor of accreditation at its summer meeting, which was conducted virtually Sept. 13. The UK-EACL is directed by Scott Stanley, PhD, faculty member in the Gluck Equine Research Center.

RMTC laboratory accreditation is earned through a rigorous review process by independent experts of the laboratory's protocols, staffing, and facilities. Candidate laboratories must also perform successfully in analyzing external quality assurance samples.

The UK-EACL joins the eight other RMTC-accredited laboratories, whose testing covers more than 92% of all pari-mutuel races in the United States.

Read the story in its entirety [here](#).

AMAZON SELLERS ARE PRICE GOUGING HORSE DEWORMER BECAUSE PEOPLE WANT TO EAT IT

A \$7 horse deworming treatment is commanding prices as high as \$45 on Amazon thanks to unfounded claims that it is a cure for COVID.

When Laura Harbin needed to deworm her horses, it took her three trips to three different stores to find ivermectin, an antiparasitic commonly used to control worms in horses. When she finally found some, it cost her \$6.49 for a single-dose tube — almost triple what she normally pays. “Everywhere [the price] has gone up. Feed stores, even online,” she told BuzzFeed News. “It's been hard to find everywhere since last summer, but it's gotten worse.”

Harbin is hardly alone. Several other horse owners in a large Facebook group from around the country told BuzzFeed News that they have seen similar increases in ivermectin prices — \$8 instead of \$5, for example. That might not seem significant, but for someone like Hardin, who owns 15 horses who use it twice a year, it can add up.

Ivermectin has been used for humans for decades, particularly for tropical diseases caused by parasitic infections. In recent months, there's been a surge of

interest in the drug based on studies (one of which seems badly flawed) claiming it can prevent and treat COVID. The FDA has warned that ivermectin is not approved for COVID use and that trials are still ongoing. (So far, there is no evidence it is effective.)

But some people whose doctors have refused to prescribe ivermectin for COVID have resorted to taking the animal version. For horses, there are edible pastes as well as liquids to ingest. Other animals take it in injectable forms. The problem is that the dosages for animals are different, and ivermectin can be toxic if taken in the wrong amount. The CDC recently reported that someone ended up in the ER after drinking liquid injectable ivermectin meant for cows.

“The dose is one thing. Formulation is another,” Martin Nielsen, DVM, PhD, Dipl. ACVM, Schlaikjer professor of Equine Infectious Disease at the Gluck Equine Research Center who specializes in equine parasitology, told BuzzFeed News. “A drug is distributed and metabolized in a certain way in a horse. The drug is formulated taking that into account. A human is not a horse, so the same drug will be distributed and metabolized very differently in a human.”

Read the story in its entirety [here](#).

FARM STRESS AND QPR SUICIDE PREVENTION

A WEBINAR FOR VETERINARIANS



October 10, 2021 at 5-7 p.m.

Did you know that veterinarians are poised to recognize stress and support farmers to help reduce stress and prevent suicides? Join Dr. Addie Reinhard and Dr. Paul Norrod, as they discuss farm stress and how you can incorporate suicide prevention into your veterinary practice.

Learning objectives:

- Discuss mental health challenges.
- Identify farm-specific stressors.
- Learn the neurochemical and biological effects of stress.
- Examine coping strategies.
- Utilize QPR for suicide prevention.



Addie Reinhard, DVM, MS is a researcher studying veterinary well-being, professional skills, and innovative interventions to support mental health and wellbeing within the veterinary profession. She is the Founder and Director of MentorVet, an evidence-based mentorship and professional development program for recent veterinary graduates.



Paul Norrod, DrPH RN, is the Principal Extension Specialist for Rural Mental Health and Safety at the University of Kentucky. His research and work focus on farm stress and occupational suicide with intervention efforts directed toward reducing farm stress and suicide in the Southeast Region. In addition to his Extension work, Dr. Norrod is a faculty member in the College of Nursing and a member of the Kentucky Nurses Association and Kentucky Nurses Action Coalition.



REGISTRATION

To register, scan the QR code with your smartphone camera, or visit <https://ukfcs.net/veterinarianqpr>



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