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Antibiotics in the Environment and Antibiotic Resistance¹

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<u>Background</u>

We share the world with a wide range of living organisms from microscopic bacteria to gigantic whales. Although we cannot see them, bacteria are all around us and are a normal part of our ecosystem and lives. Different kinds of bacteria are in competition with each other for nutrients and living space. Bacteria are specialized and fill various niches in the environment. For example, the soil is full of bacteria that live off of soil nutrients, moisture and decaying material. Other bacteria live best in the bodies of people and animals, benefiting them, while others cause disease.

Some soil bacteria naturally produce substances (antibiotics or antimicrobials) that inhibit the growth of other bacteria. Scientists cultivate these soil bacteria and collect the antibiotics produced. The antibiotic may be given to people to help fight infections or disease caused by other bacteria. Not all bacteria are affected the same way by the specific type of antibiotic. While the growth of non-resistant bacteria is suppressed, resistant bacteria can continue to live in the presence of antibiotics. Resistance is the inherent ability of some bacteria to resist being killed by an antibiotic. Resistance was present prior to the use of antibiotics and occurs as a result of genetic mutation or when extra chromosomal DNA (plasmid) is acquired from other bacteria. In theory, antibiotic use selects for resistant bacteria, allowing them to multiply without the competition of antibiotic-susceptible bacteria.

The literal meaning of the word antibiotic, used commonly for decades, is "against life." It is less precise than the term "antimicrobial" which means "against microbes." In this bulletin the two names are used interchangeably despite the scientifically more accurate meaning of the term antimicrobial.

Antimicrobials are used in human medicine and animal agriculture to reduce disease and death. They are given by injection, orally, and in food and water to prevent or treat of diseases, and as growth promoters. Exact amounts currently manufactured and used are not available.

Antibiotics used for growth promotion, lessen the effects of sub-clinical disease, thus food consumption, weight gain, and the efficiency of food use for growth are improved. They are not effective when disease is absent.

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What about antibiotics from livestock production entering the environment? Will antibiotics used in livestock production have a negative impact on ground or surface water?

Chemicals used in homes, manufacturing, and agriculture can enter the environment in wastewater. A 1999 study by the Toxic Substances Hydrology Program of the U.S. Geological Survey found a range of chemicals in residential, industrial and agricultural wastewaters and at low concentrations in surface waters. The chemicals included human and veterinary pharmaceuticals (including antibiotics), natural and synthetic hormones, detergent metabolites, plasticizers, insecticides, and fire retardants. Measured concentrations of pharmaceuticals in wastewaters were much lower than would be found if a person or animal were consuming the chemical. Most are detected in water at concentrations less than 1 microgram per liter. These amounts are relatively small compared to the dosage provided to humans and animals to treat disease. For example, the antibiotic tetracycline may be given to humans at a rate of 2 grams per day, usually in 2 to 4 pills taken orally. If given to pigs as a growth promoter, the dosage is 0.05 grams per day. Higher concentrations occurred in sediments because of sorption. In Huron County, Michigan, a USGS study found both human-use and veterinary-use antibiotics in stream (surface) water, but not in groundwater (Duris and Haack, 2004). Whether these findings are of biological, environmental or health consequence are currently unknown. Research is being proposed and conducted.

Up to 40% or more of the antibiotic dose may be excreted, especially for antibiotics given at therapeutic doses (Boxall et al., 2004). This is true for both humans and animals. However, different classes of antibiotics are more or less metabolized. Antibiotics are excreted in urine and feces either unchanged or metabolized in the form of the conjugated, oxidized or hydrolyzed products of parent compounds.

Antibiotics may enter the environment in wastewater, or when human waste solids and animal manures are applied to cropland as plant fertilizer. Some antibiotics degrade quite slowly, possibly surviving the processes of storage and handling, and may be present in land-applied biosolids. The continual land application of bio-solids could cause the rates of antibiotic accumulation in soils to exceed the rates of degradation. However, accumulation in soils is less probable as environmental regulations and voluntary generally-accepted management practices limit manure application so that applied nutrients meet the requirement of the crop being grown.

Understanding the fate and transport of antibiotics in the environment is essential to assess their impact and subsequent risks to ecosystems. Sorption (absorption or to take up; and adsorption or to hold) by soil plays a determinant role in controlling transport, bioavailability and hence fate of antibiotics in the environment. The complicated chemical structures of antibiotics lead to multiple interactions with soils (Tolls, 2001). In general, soil organic matter and minerals are the two soil components responsible for holding antibiotics. A few studies have attempted to address the sorption mechanisms, but so far they are far from being fully understood.

Do antibiotics used in animal agriculture enter the human food chain through plant uptake? If so, at what <u>level?</u>

In 2005, Kumar and others reported that green onion, cabbage, and corn plants can take up small amounts (2 to 17 nanograms per gram of fresh tissue) of chlortetracycline from soil which had been amended with swine manure known to contain that antimicrobial. Uptake of the antibiotic tylosin was not observed. Other researchers have not been able to produce similar results. The assay to detect the antibiotics was an enzyme-linked immunosorbent assay (ELISA). This assay reportedly suffers from significant detection interferences from natural organic matter that can be derived from plant tissues (Huang and Sedlak, 2001). A carefully designed and laborious clean-up procedure may enhance the accuracy of ELISA measurements; however, the results should be confirmed with more conclusive analysis techniques such as gas chromatography and mass spectrometry or liquid chromatography and mass spectrometry.

Will antibiotics used in animal agriculture lead to antibiotic resistance in human strains of bacteria?

It is possible, but a link between agricultural use of antimicrobials and antibiotic-resistant human infections has not been proven, only speculated. The incidence of human disease caused by antibiotic resistant organisms is not greater in people working on livestock farms as compared with those who do not. In the past, cases of what was believed initially to be resistant bacteria from animals spreading to man were headlined in the press. But when these potential examples were examined closely, other more usual risk factors (such as antibiotics already in people before infection or a hospital stay) were present and much more of a health risk.

Antibiotics have been used in animals over 60 years. However, antibiotic resistance only recently has become a major medical concern in hospitals. Whenever a population of bacteria, of importance to animals or humans, is exposed to an antibiotic it encourages the predominance of the most resistant strains of the bacteria. The most well-known example of this is how rapidly gonorrhea became resistant to penicillin. It is possible for resistant bacteria from animals to make their way into humans, but many barriers stand in their way. Most bacteria that cause animal diseases are specialized for that species (species-specific) and poorly invade humans. Zoonotic bacteria, such as certain species of Escherichia coli and Salmonella are of greater concern as they are transmissible from animals to humans. Usual precautions of washing hands and thoroughly cooking of foods eliminate the spread of these to humans, but these procedures do not help prevent environmental transmission (e.g., to drinking water).

Antibiotic resistance can occur in bacteria even when the antibiotics have not been used. Researchers found tetracycline- and tylosinresistant bacteria in manure samples taken from storage facilities of swine farms where antimicrobials were not being used (Chander et al., 2006). Likewise, Smith and others (2007) reported that resistance of E. coli to tetracycline, sulfonamides and streptomycin was similarly prevalent in feces of broiler chickens both receiving and not receiving antibiotics. Chander and others (2006) also reported that tetracycline and tylosin resistant bacteria were isolated in soil of fields where manure was applied "regularly" and in the feces of dogs kept as pets on the farm. But, the prevalence of resistant bacteria did not differ among farms using or not using antimicrobials as a feed additive for growth promotion.

Bacteria have complex genetic means for transferring resistance. Some scientists hypothesize that cause (antibiotic use) and effect (antibiotic resistance) may be linked. Doubtless, detailed exploration of microbial genetics will evaluate this suggestion in the future.

If we discontinue the use of antibiotics for growth promotion and disease prevention will that decrease the risks associated with using antibiotics in animal agriculture?

This was the thinking in Denmark and some European countries where use of low levels of many antibiotics in livestock was banned. Monitoring the prevalence of antibiotic resistant bacteria in animal manure found lower numbers after the ban. The designers of the antibiotic ban used this finding to claim success. However, when examining a more immediate outcome such as the level of resistant infections in people the results were not clear. The animals raised for food in these countries now have a lower health status and their mortality rate has increased. Because of the lower health status, it is more expensive to raise food and the incidence of resistant infections affecting people has not decreased. Total antimicrobial use has decreased slightly, but therapeutic usage has surpassed growth promoter usage prior to the ban (DANMAP, 2005). Banning use of antimicrobials for growth promotion did not affect the incidence of antimicrobial residues in foods or the incidence of Salmonella, Campylobacter, or Yersinia infections in humans (WHO, 2003).

<u>Are animals raised in large facilities healthier or less healthy than animals raised on small and medium sized</u> <u>farms?</u>

It is very difficult to conclude that animal health is related to size of the farm. There have been no controlled studies evaluating this. Retrospective data suggest that this is true, if one assumes that the amount of antibiotic use is correlated positively with the amount of disease. A survey conducted by the National Animal Health Monitoring System (NAHMS; 2002) found that 78% of farms with 2,000 or less pigs used feed-grade antibiotics as compared with 94% of farms with 10,000 or more. However in 2005, NAHMS released a report on dairy farming documenting that a greater percentage of large (500 or more cows) and medium-sized (100 to 499 cows) operations fed antimicrobials in heifer (pre-lactation) rations than did small (less than 100 cows) operations (36%, 30% and 15%, respectively). Note that antibiotics that might appear in milk are not approved for feeding to lactating dairy cows. Antibiotics are not allowed to be present in milk for public sale according to the Federal Drug Administration's Grade A Pasteurized Milk Ordinance under the Federal Food, Drug and Cosmetics Act. Similar percentages of small (1,000 to 7,999 head) and large (8,000 head or more) beef feedlots practice antimicrobial feeding and (or) watering (NAHMS, 1999). However, the assumption that the amount of antibiotic use and the amount of disease may be related may not be valid because large farms have better record keeping systems and make greater use of veterinary services and disease diagnostics. Simply, there are more accurate data and greater veterinary use on large farms for reasons other than disease occurrence alone.

References

- Boxall, A.B.A., P. Kay, P.A. Blackwell and L. A. Fogg. 2004. Fate of veterinary medicines applied to soils. Pp. 166-180 in Kummerer, K. (ed.) Pharmaceuticals in the environment: Sources, fate, effects and risks. Springer.
- Chander, Y, S Gupta, S Goyal, K Kumar, and H Murray. 2006. Prevalence of antibiotic resistant bacteria on swine farms. Proc. ASA/ CSSA/ SSSA International Annual Meetings. November 12-16.
- DANMAP (Danish Integrated Antimicrobial resistance Monitoring and Research Programme) Y Agersø, H-D Emborg, O Heuer, VF Jensen, AM Seyfarth, AM Hammerum, L Bagger-Skjøt, A-M Rogues, C Brandt, RL Skov, and DL Monnet. 2005. Use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, foods and humans in Denmark. Ole E. Heuer and Anette M. Hammerum; ed's. www.danmap.org
- Duris, Joseph W. and S. K. Haack, 2004, Water-Quality Data, Huron County, Michigan. U.S. Geological Survey Open-File Report 2005-1380. (http://pubs.usgs.gov/of/2005/1380/)

Huang, CH, and DL Sedlak. 2001. Analysis of estrogenic hormones in municipal wastewater effluent and surface water using enzymelinked immunosorbent assay and gas chromatography/tandem mass spectrometry. Environ. Toxic. Chem. 20:133-139.

Kumar, K., S.C. Gupta, S. Baidoo, Y. Chander, ad C.J. Rosen. 2005. Antibiotic uptake by plants from soil fertilized with animal ma-(Continued on Page 4) nure. J. Environ. Qual. 34: 2082-2085.

- NAHMS (National Animal Health Monitoring System). 1999 2005. United States Department of Agriculture Animal and Plant Health Inspection Service. http://www.aphis.usda.gov/vs/ceah/ncahs/nahms/index.htm
- Smith, JL, DJV Drum, Y Daj, JM Kim, S Sanchez, JJ Maurer, CL Hofacre, and MD Lee. 2007. Impact of antimicrobial usage on antimicrobial resistance in commensal Eshcerichia coli strains colonizing broiler chickens. Appl. and Environ. Microbiol. 73:1404-1414.
- Smith, KE, JM. Besser, CW. Hedberg, FT Leano, JB Bender, JH Wicklund, BP Johnson, KA Moore, and MT Osterholm. 1999. Quinolone-Resistant Campylobacter jejuni Infections in Minnesota, 1992–1998. New England Jour of Med. 340(20):1525-1532.
- U. S. Geological Survey, Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams. USGS Fact Sheet FS-027-02 (http://toxics.usgs.gov/pubs/FS-027-02/index.html).

Tolls, J. 2001. Sorption of veterinary pharmaceuticals in soils: A review. Environ. Sci. Technol. 35:3397-3406.

WHO (World Health Organization). 2003. Impacts of antimicrobial growth promoter termination in Denmark. Foulum, Denmark, 6-9 November 2002. http://whqlibdoc.who.int/hq/2003/WHO CDS CPE ZFK 2003.1.pdf

Electronic Identification in Traceable Systems

Ronald O. Bates, State Swine Specialist, Michigan State University

Introduction

As pork chains become more diverse and with increased stringency of some export specifications, animal identification (ID) and traceability is a key component regarding assurance of customer specifications for livestock products. Furthermore as more and more pork production chains gravitate to scripted management programs, which ensure unique conception to consumption practices, the ability to guarantee that each animal marketed was managed and treated as asserted is paramount for the success of these programs. Documentation of declared management and health treatment protocols is becoming the preferred way to certify that the stated management methods were those that were actually performed.

Animal Identification

Over the years many different methods have been used to identify pigs. Traditionally, pigs have been ear notched using the Universal Ear Notching system. In addition visual identification tags, typically ear tags, have been commonly used. These two methods have been used extensively in many different ways to identify pigs within and across production systems. Over the last decade there has been an increasing interest in using electronic identification (e-ID) to identify groups of animals as well as individual animals.

Most e-ID systems are passive systems that require the e-ID placed on or in an animal. The e-ID devise must pass through an antenna field to energize the e-ID device and allow a unique identification number or code to be transmitted to a reader. One of the main reasons that e-ID has come to the forefront of animal ID systems is the ability to capture the electronically transmitted number or code into an electronic database. When electronically transmitted, the identification number can be used to tie present and past histories of that animal together quickly, and it can be used in management applications such as feeding or sorting. As an example, when treating animals an animal that has just been treated can be identified by an e-ID reader that is tied to an electronic database for data recording purposes. The treatment given can also be recorded electronically and all information can be merged into a historical database. This can eliminate many paper and pencil activities, reduce mis-identification of animals as well as provide database queries regarding management histories on animals in a convenient manner within the barns of a production system.

The two major questions regarding the implementation of e-ID typically revolve around reliability and affordability. The e-ID devises have become much more affordable in recent times and continue to decline in price. Reliability though is a multi-pronged issue. For an identification system to be reliable, it must be easily readable, not fail for an extended period of time, and it must remain on or in the animal. Regarding e-ID, the International Committee for Animal Recordings states that for e-ID to be considered for official ID systems it should have a retention rate of or greater than 98% (ICAR, 2005).

Concerning traceability for export or scripted production systems, documentation of animal management and health treatment is critical to assure end product users that the purchased product was raised to the specifications stated. The potential to trace the pork in a box or package back through the harvest facility and to the farm on which the animal was raised is feasible with the ability of passing animal identification across databases. In fact there are pork chains around the world that are presently doing this to some degree.

Yet questions still remain concerning the reliability of e-Id. Recently there were two reports published that compared visual identification systems (visual ear tags) with different e-ID systems. These reports were companion manuscripts that eval-





Adapted from Babot et al., 2006

uated visual ear tag ID and compared it with e-ID that was either placed behind a visual ear tag or was an implanted e-ID bolus placed into the peritoneal cavity (stomach and intestine area). These studies were conducted on two different farms in Spain and included 4,434 pigs across both farms. Pigs were individually identified within the first three weeks after birth and followed through the harvest process (Babot et al., 2006; Santamarina et al., 2007). Regarding e-ID both half-duplex and full-duplex e-ID technology were included in the study. Half-duplex e-ID must send and receive its signal sequentially while full-duplex technology allows for its signal to be sent and received simultaneously. The implanted e-ID bolus was injected into the abdominal cavity between the intestines. Pigs were laid on their back and the injection site was cleaned with iodine. The injection site was .4 inches from the pig's left of the midline and .8 inches below the navel. Injection of the e-ID bolus into the abdominal cavity took approximately 1 minute per pig.

Pig performance and mortality rates were similar across ID types. Readability rates did differ between different ID systems (Figure 1). Readability included both retention of the ID as well as functionality of the ID. Pigs that had visual ear tag ID or the implanted e-ID bolus had similar readability rates at the time of marketing. This included the time from ID placement on or in the pig until the time pigs were marketed at approximately 220 lb. However, pigs with e-ID placed on an ear tag had lower readability rates. For the 3.7% of the ear tag e-ID that could not be read, 61.7% of the non-readers were due to loss of the e-ID devise from the ear tag. The remaining 38.3% of the non-readers, did remain on the ear tag but had lost functionality and could not be read at the time of marketing. It appears that an e-ID devise placed on an ear tag as the back of a tag can have a greater non-readability rate than standard ear tags. Implanted e-ID within the abdominal cavity was similar in functionality rate to visual ID.

At the end of the finish phase, pigs were marketed to one of two harvest facilities with line speeds of 400-600 carcasses per hour. After exsanguination, carcasses were scalded, de-haired and then moved through a flame chamber to remove all remaining hair. Each ID system was read after the carcass was moved through the flame chamber and before evisceration. Readability rates were highest for pigs with implanted e-ID and lowest for e-ID on ear tags (Figure 2). Visual ID systems were intermediate.

There was a significant difference in readability rates between the two ear tag e-ID systems. Carcasses with the half-duplex ear tag e-ID had a readability rate of 91.4% while pigs with the full-duplex ear tag e-ID had a readability rate of 84.5%. It was not apparent as to why this difference occurred. The half-duplex and full-duplex e-ID devises, were of the same size, shape, dimension and weight.

Recovery of the implanted e-ID bolus from the viscera tray after evisceration, across the two harvest facilities ranged from 85.5 to (Continued on Page 6)

Figure 2. Readability Rate of Identification Systems in Pigs through Harvest



Adapted from Santamarina et al., 2007

90.8%. The remaining boluses fell from the carcasses during evisceration and were lost on the harvest facility floor. None of the e-ID boluses were found within the carcasses after evisceration. Within this study there was no risk of the e-ID bolus passing through the food chain in pork products.

This study demonstrated that different ID systems could be used within verified production systems and the ID can remain functional for a majority of the pigs initially identified. However there were differences across identification systems. The greatest percentage of pigs which were initially identified and individually tracked through the evisceration phase of harvest was those implanted with e-ID boluses. The nearly perfect traceability rate met the standards proposed by the International Committee for Animal Recordings. Therefore in those countries in which this standard is required for scripted production systems or export specifications, this method of ID can be considered for use.

The study also demonstrated that tracking 100% of animals through a production system and harvest facility is very difficult. This becomes further complicated if production and management information is to be matched with individual carcasses so to verify 100% of carcasses were from pigs which matched the scripted management system for particular pork chains. Pork chains that choose to move information from the production system through the harvest facility to the end user will have to plan carefully which ID systems will best fit their consumer specifications and what degree of traceability is acceptable.

<u>Literature Cited</u>

- Babot, D., M. Hernandez-Jover, C. Caja, C. Santamarina and J,J, Ghirardi. 2006. Comparison of visual and electronic identification devices in pigs: On-farm performances. J. Anim. Sci. 84:2575-2581.
- ICAR. 2005. International Agreement of Recording Practices. Guidelines approved by the General Assembly held in Sousse, Tunisia, June 2004. International Committee for Animal Recording, Rome, Italy.
- Santamarina, C., M. Hernandez-Jover, D. Babot, and C. Caja. 2007. Comparison of visual and electronic identification devices in pigs: Slaughterhouse performance. J. Anim. Sci. 85:497-502.

2008 Lactating Sow Management for Improved Litter Performance and Rebreeding Efficiency

Course Schedule: Group discussion workshops will be held at four locations throughout the state. All meetings are from 5:00 to 8:00 pm.

Date	Location		
Jan. 30 Jan. 31	Coldwater - Dearth Community Center, Branch Co. Fairgrounds Zeeland - Zeeland Township Hall, 6582 Byron Road		
Feb. 6	Cassopolis - MSU Extension Office, 120 N. Broadway, Suite 209		
Feb. 7	Mt. Pleasant - Isabella Co. Bldg., 3rd Floor, 200 N. Main		
Topics covere	ed in the course include:		
* Feeding the	e lactating sow for improved litter performance and rebreeding efficiency		
8	Dr. Dale Rozeboom. MSU Extension Swine Specialist		
* Water need	s for sows and nursing niglets		
water need	Tom Guthrie MSU Extension Educator - Pork		
* Cross fosta	ring niglets do's and don'ts		
C1035 105ter	Ing pigicis, up s and up is Dr. Barb Straw MSU Extension Swine Veteringrian		
*D l	Dr. Daro Siraw, MSO Extension Swine veterinarian		
*Reproductiv	e drugs, are they worth it?		
	Dr. Ron Bates, MSU Extension Swine Specialist		
* Fine points	of heat detection		
	Dr. Danny Burns, Genetiporc		
* Circo virus	- Vaccine timing, dosage, pig management & handling		
	Paul Knoernschild, DVM, Fort Dodge Animal Health		
* Cost, return	ns and animal performance from rescue decks		
,	Jerry May, MSU Extension Educator - Pork		
Name	Address		
City	State Zip		

Cost: \$25.00 per person or \$20 per person for 5 or more per farm or \$250 for unlimited number of participants per farm. Registration fee includes all materials and refreshments. Registration deadline for the **Coldwater** and **Zeeland** meetings is **January 23, 2008**. Registration deadline for the **Cassopolis** and **Mt. Pleasant** meetings is **January 30, 2008**. For additional information call Jerry May at (989) 875-5233.

Make check payable to: MSU Extension - Gratiot County. *Send payment to:* MSU Extension - Gratiot County, ATTN: Lactating Sow Management

Check which location you will attend:

 \Box Coldwater \Box Zeeland \Box Cassopolis \Box Mt. Pleasant

Brought to you by: MSU Extension, Genetiporc, Inc., and Fort Dodge Animal Health

Refreshments & snacks provided

- 1. Jerry May, North Central Pork Educator Farm Records, Productions Systems (989) 875-5233
- 2. Ron Bates, State Swine Specialist Michigan State University (517) 432-1387
- 3. Dale Rozeboom, Pork Extension Specialist Michigan State University (517) 355-8398
- 4. Barbara Straw, Extension Swine Veterinarian Michigan State University (517) 432-5199
- Glynn Tonser, Livestock Extension Economist Michigan State University (517) 353-9848
- 6. Roger Betz, Southwest District Farm Mgt. Finance, Cash Flow, Business Analysis (269) 781-0784
- 7. Tom Guthrie, Southwest Pork Educator Nutrition and Management (517) 788-4292
- Beth Franz, Southwest Pork Eduator Value Added Production; Youth Programs (269) 445-4438

PQA PLUS CERTIFICATION SESSIONS

PQA Plus training sessions for pork producers will be held starting at 2 pm at:

CITY	DATE	LOCATION
Coldwater	January 30	Dearth Community Center, Branch County Fairgrounds
Zeeland	January 31	Zeeland Township Hall, 6582 Byron Rd
Cassopolis	February 6	MSU Extension Office, 120 N. Broadway, Suite 200
Mt. Pleasant	February	Isabella County Bldg 3rd floor, 200 N. Main

Registration will be \$20 per person. In the past, the PQA program has provided consumers with assurance that pork is wholesome and not contaminated with any residues. Today, by completing the program, producers demonstrate, that pigs are raised humanely. This training will renew your PQA certification. Because a welfare component has been added to the previous PQA Level III program, your previous PQA certifier may not be able to provide this training when your PQA certification is up for renewal.

The following are certified advisors who can provide PQA Plus training:

Ag Consultants/Veterinarians

Andres Contreras, DVM, Tamera Hyatt, James Kober, DVM, Melissa Souva, Duane Trupiano, DVM.

MSU Pork Team

Ron Bates, Tom Gutrie, Beth Franz, Jerry May, Dale Rozeboom, Janice Siegford, Barb Straw.



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