The FARAD Model to Help Prevent Residues in Human Food

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While impacts of antibiotic overuse in animal agriculture are currently receiving significant attention by public policy-makers and news media outlets, efforts to curtail chemical residues in human food have been in place for many years. Since the early 1980's the United States Department of Agriculture (USDA) Extension Service has been involved in activities designed to enhance safety of animal-derived foods through the Residue Avoidance Program (RAP) founded by the USDA Food Safety and Inspection Service (FSIS). The primary focus of RAP's activities has been on chemical residues and the reduction of rates of animal residue violations through education. To support these activities the Food Animal Residue Avoidance & Depletion Program (FARAD) was developed by pharmacologists and toxicologists at four U.S. universities. FARAD is a computer-based decision support system and repository of comprehensive residue avoidance information that provides livestock producers, extension specialists, veterinarians, and feed producers with practical information to help avoid drug, pesticide and environmental contaminant residue problems. This seminar will discuss essential components of the FARAD system and how it can be used to assist in reducing antibiotic residues in human food.

防止人类食品残留物的 FARAD 模型

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目前，畜牧业中抗生素的滥用带来的影响受到了公共政策制定者和新闻媒体的高度关注，与此同时，多年来人们一直在努力减少人类食品中的化学残留。自二十世纪八十年代早期，美国农业部食品安全与检验局（FSIS）建立了残留物避免项目（RAP），而美国农业部推广局一直参与其中，致力于提高动物源性食品的安全性。RAP 主要关注化学残留，并通过教育降低动物残留违规行为的比率。为了支持这一项目，美国四所大学的药理学家和毒理学家们创建了食品动物避免和消除残留物项目（FARAD）。FARAD 是一种基于电脑的决策支持系统和残留物避免信息的综合资源库，它能够为家畜生产者、推广专家、兽医和饲料生产者提供实用的信息，从而避免药物、杀虫剂和环境污染残留问题。这个研讨会将讨论 FARAD 系统的重要组成，以及如何将其应用于减少人类食品的抗生素残留。

Proposed Curriculum for One Health in Food Safety

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The challenges of producing adequate food to feed an estimated 9 billion people by 2050 without destroying earth's finite resources are creating extremely difficult food safety problems that lack simple solutions. Such problems are extremely complex and have been described as 'wicked problems' that will require a One Health approach to solve. This approach considers not only the immediate problem, but also the complex web of upstream factors related to the problem. The ability of modern societies to adequately address such food-related problems will require an educated workforce trained not only in traditional food safety, security, and public health, but also in other areas including food production, sustainable practices, and ecosystem health. To our knowledge no well-defined curricular framework exists for guiding education and training in food safety and security that embraces the many diverse disciplines that are involved in production of safe and secure food supplies. To help address this need we designed a One Health in food safety and security curricular framework to assist those tasked with designing education and training for future food systems workers including food sanitarians, producers, manufacturers, researchers, teachers, and policy-makers. In this seminar the development and design of this novel curricular framework will be discussed.

万物健康食品安全课程计划

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到 2050 年，在不破坏有限的地球资源的前提下，生产出足够养活约 90 亿人口的食物将成为一大挑战，它造成了极其困难的食品安全问题并且难以通过简单方式解决。这些问题极其复杂，并被称作为“棘手问题”，它需要通过一种万物健康的方式来解决。这一方法不仅考虑当前的问题，它同样考虑相关的上游因素形成的复杂网络。要想充分解决这些食品相关问题，现代社会需要的人才应不仅在传统的食品安全、保障和公众健康方面，还应在其他如食品生产、可持续实践和生态系统健康领域受过教育。据我们所知，食品生产和供应安全涉及多种学科，而目前还没有明确的课程框架来指导食品安全的教育和培训。为满足这一需求，我们设计了这个万物健康食品安全课程框架，该课程框架可以指导设计人员，为未来的食品系统工作者，如食品卫生学家、生产商、制造商、研究者、教师和政策制定者，设计教育和培训方案。本次研讨会将讨论这一全新的课程框架的开发与设计。

Dairy Dynamic Management: More Quality Milk - More Profits

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What makes a dairy successful? It can be a small herd of 10 cows or a large herd of 50,000 cows - the answer is the same: Maximum Productivity, (Kg of milk/worker, assets/cow/liter of milk), Cost Control, Efficient Facilities, and Quality of life for the animals and workers. All of these depend upon the "Human Assets" on the farm - how well trained are they in animal health and well-being, public health, ecosystem health, food safety and the profits derived from a wall (WELL) managed dairy farm. The Dairy Dynamic Management (DDM) program developed at UC Davis is a practical way to train the managers and employees in all of the areas mentioned above. When using this practical management technique, DDM trains the managers and employee how to identify current and future problems before they occur, then develop the necessary solutions to effectively eliminate those problems which results in more high quality, safe milk and more profits for the farm. Your consumers are watching. The world is watching China to see how you take care of animal health, public health, ecosystem health and food safety.

乳品厂动态管理：更高品质的牛奶—更多的利润

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加州大学戴维斯分校
乳制品安全实验室

是什么让一个乳品厂成功？它可能是仅由 10 头奶牛组成的小型牛群，也可能是由 50000 头奶牛组成的大型牛群，然而答案却是一致的：最高生产率（牛奶公斤数/工人，资产/奶牛/产奶升数）、成本控制、高效设施以及动物和员工的生活质量。以上的这些要求都建立在农场“人力资本”的基础上——员工是否在包括动物健康与幸福、公共健康、生态系统健康、食品安全以及封闭式管理的乳牛场利润等方面

受到了良好的训练。UC Davis 研发的乳品厂动态管理（DDM）项目是一种切实可行的训练方法，它能为管理者和员工提供上述所有方面的培训。在应用这个实用管理技术时，DDM 会训练管理者和员工如何在当前的或未来的问题发生前就把他们辨认出来，然后采取必要措施将其有效根除，从而为农场带来更高品质、更安全的牛奶和更多利润。消费者们正在关注，世界也在拭目以待，看中国如何兼顾动物健康、公众健康、生态系统健康和食品安全。

Industry on Antibiotic Use

Jessica Light DVM, MA
Senior Veterinarian
Dairy Technical Services California Agricultural Leadership Foundation, Zoetis

Zoetis discovers, develops, manufactures and commercializes a diverse portfolio of animal health medicines and vaccines designed to meet the real-world needs of veterinarians and the livestock farmers and companion animal owners they support.

Zoetis provides a diverse portfolio of animal health products and services for dairy cattle. We also work with dairy farmers and veterinarians around the world to help them make informed decisions that contribute to improving the health of their herd and maximize the potential and profitability of their dairy operation under sustainable conditions.

Today I will share with you some of the strategies I use as I support the California dairy industry as a Zoetis Technical Service Veterinarian and promote antimicrobial stewardship. We will discuss ways to influence producers and veterinarians to use on-label drug choices. We will highlight the profound impact that good treatment records have on dairy compliance. Protocol development and adherence will be reviewed as another instrument to best use antimicrobials on farm. Lastly, we will discuss considerations for choosing animals for harvest.

抗生素使用产业

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高级兽医
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硕腾领袖基金会

硕腾（Zoetis）发现、开发、制造和商业化多种动物健康药品和疫苗的投资组合，旨在满足兽医以及他们所支持的畜禽养殖户和伴侣动物主人的现实需求。

硕腾为奶牛提供多样化的动物健康产品和服务。我们还和全世界的奶牛养殖户以及兽医们一同工作，帮助他们做出知情的决定，从而提高畜群的健康水平，并且在可持续的条件下将他们奶牛场的潜力和收益最大化。

今天我将与你们分享我作为一名硕腾的技术服务兽医和促进抗菌药物使用管理员，所用的支持加州乳制品产业的策略。我们将讨论影响生产者和兽医使用正规商标药物选择的方法。我们将强调良好的治疗记录对对乳制品合规性的重要影响。我们会回顾协议的发展过程和相关附则，这是另一类在农场中使用杀菌剂的最佳指导。最后，我们会讨论选择屠宰动物的一些注意事项。

Industry Approaches to Help Ensure Appropriate Use of Antibiotics in Dairy Production

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Senior Veterinarian
Dairy Technical Services California Agricultural Leadership Foundation, Zoetis

At Zoetis, we make positive contributions to the communities where we live and work. We recognize that our ability to improve the world goes beyond the medicines and vaccines we develop. We strive to use our local presence and global scale, commitment to veterinary medicine and the full range of our company's resources - our people, products and expertise – to improve the communities where we live and work.

We approach our work with the understanding that protecting animal health helps protect and enhance human health. This takes shape in our efforts to help control zoonotic diseases which can pass between animals and people and threaten the lives of both. It also takes shape in our efforts to help farmers raise healthy farm animals, which is the foundation of a sustainable supply of wholesome animal protein. We see an abundant and safe food supply as an important component of wellbeing. We work to advance the responsible use of veterinary medicines in the interest of animal and human health.

Today, I will specifically be discussing my work within the California dairy industry as it relates to healthy cows, healthy dairies and healthy food products.

帮助确保乳品生产中的抗生素正确使用的工业方法

Jessica Light DVM（兽医学博士）, MA（文科硕士）
高级兽医
加州农业乳液科技服务项目
硕腾领袖基金会

在硕腾（Zoetis），我们对生活和工作的社区做出了积极贡献。我们意识到我们改善世界的能力超出所开发的药物和疫苗之外。我们努力通过利用本地优势和全球规模、对兽药的投入以及公司的全套资源——我们的人力资源、产品和专家，来改善我们生活工作的社区。

我们是以这样一个理念开展工作——保护动物的健康就是保护和增强人类的健康。这个想法成形于我们帮助控制能够导致人畜共患的动物传染病时。它也成形于帮助农民养殖健康的农场动物时，因为它们是健康动物蛋白的可持续供应源。我们将丰富和安全的食品供应看作是幸福的重要组成部分。为了动物与人类健康，我们致力于促进负责任的兽药使用方式。

现今，我将专门讨论我在加利福尼亚乳制品厂的工作，因为它与健康的奶牛、健康的奶制品以及健康的食物产品息息相关。

Interactions between Plants and Human Pathogens

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Enterohemorrhagic *Escherichia coli* and *Salmonella enterica* appear to be the most common causal agents of food poisoning associated with the consumption of fresh leafy vegetables. These human pathogens are not proven to be plant pathogens yet. Nonetheless, under certain conditions these bacteria can survive on and penetrate into plant tissues causing serious food borne disease outbreaks. We have identified components of the plant immunity system that are regulated in the presence of either *E. coli* O157:H7 or *S. enterica* serovar Typhimurium SL1344. During the epiphytic phase, O157:H7 induces strong and lasting stomatal closure, whereas SL1344 induces a transient closure in both the model plant Arabidopsis and lettuce. These findings raise the possibility that not only plant pathogens (some pathovars of *Pseudomonas syringae* and *Xanthomonas campestris*), but also some human pathogens (SL1344) have evolved mechanisms to subvert stomatal defense to enter plant tissues and survive endophytically. It is equally possible however, that SL1344 is able to evade recognition by the plant immune system. Using high throughput technologies, we have also observed that SL1344 does not induce very strong apoplastic immunity as compared to O157:H7. Recent results highlighting the differential plant responses induced by these two human pathogens will be discussed.

植物与人类病原体的相互作用

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肠出血性大肠杆菌和沙门氏菌似乎已成为因食用新鲜绿叶蔬菜导致食物中毒的最常见病因。目前为止，这些人类病原体尚未被证实是植物病原体，尽管如此，在某些情况下，这些细菌能够存活并侵入植物组织，造成严重的食源性疾病的爆发。我们已经鉴定出，某些植物免疫系统成分能在有大肠杆菌 O157:H7 或鼠伤寒沙门氏菌 SL1344 血清型出现时受到调控。在附生阶段，O157:H7 会诱发强烈而持久的气孔关闭，但是 SL1344 在模式植物拟南芥和莴苣中诱发的是暂时的气孔关闭。这些发现增加了除植物病原体（某些致病型如*丁香假单胞菌 和 野油菜黄单胞菌*）外，某些人类病原体（SL1344）同样进化出了能够破坏气孔防御、进入植物组织并在其内部存活的机制的可能性。但是，同样有可能的是，SL1344 能够逃避植物的免疫系统识别。通过使用高流通量技术，我们还观察到，与 O157:H7 相比，SL1344 并不引起十分强烈的胞外免疫。近期结果强调了这两种人类病原体是能够引发不同植物应答的，并将对其进行讨论。

Antibiotic Use, Misuse and Monitoring in Dairy Production in the U.S. and California

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World War II saw the first large-scale production of penicillin and its use in human hospitals. Toward the end of the war penicillin formulations were also first introduced for intra-mammary treatment of mastitis in dairy cows. The subsequent discovery that feeding antibiotics improved weight gain and feed efficiency eventually lead to widespread inclusion of antibiotics in livestock rations in the 1950's. Since these first uses of antibiotics in food animals, human and veterinary medicine have struggled with the issues of antibiotic residues in foods of animal origin, as well as how to limit development of antibiotic resistance. This presentation will address historical challenges with antibiotic residues in milk and tissue and regulatory initiatives implemented to solve them. Similarly concerns related to promotion of antibiotic resistance have led to changes in federal and state law regarding access and use of antibiotics in food animals. Also included will be an overview of veterinary drug approval in the United States, substances banned in food animals, sampling and testing programs for adulterants and prevention of environmental contamination with livestock medications.

美国与加州乳制品的抗生素使用、滥用和监控

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二战见证了世界上首次青霉素的大规模生产及其在人类医院中的应用。战争末期，青霉素的配方也被初次应用在奶牛乳腺炎的乳房内治疗中。随后的发现表明，在饲料中添加抗生素有助于奶牛体重的增长和饲料利用率的提高，这也使得在 20 世纪 50 年代出现了在饲料中广泛添加抗生素的现象。自从抗生素在食品动物中的初次应用，人类和兽医一直面临着食品中动物源性抗生素残留问题，以及如何控制抗生素耐药性的问题。本次演讲将展示的内容包括：牛奶和组织中的抗生素残留这一历史性挑战，以及为了解决这些问题而实施的管理法案。类似地，与日俱增的抗生素耐药问题，促使联邦与各州法律中有关获得抗生素或在食品动物中使用抗生素的部分均有所调整。同时，演讲中还将包含其他内容，比如美国兽药大致的批准情况、食品动物中禁用的添加剂、掺杂物的取样与检测和防止家畜用药导致的环境污染等。

Environmental Contamination of Food Animals: Case Histories from the U.S.

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There are numerous antibiotics, pesticides, herbicides, fungicides, rodenticides, fertilizers and other chemicals that are routinely used in agricultural setting. On occasion these compounds can contaminant livestock and poultry feeds necessitating an assessment of the human food safety risk and regulatory action. Using cases submitted to the U.S. Food Animal Residue Avoidance Databank (FARAD), this presentation reviews how contamination cases are accessed and recommendations made. Include are discussion of development of the case history and estimate of exposure, identification of Tolerance, Maximum Residue Level or Action Level, search of published and unpublished data and formulation of recommendations for an appropriate withdrawal period or testing program.

食品动物的环境污染问题：美国历史案例

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在农业生产中，抗生素、杀虫剂、除草剂、杀真菌剂、灭鼠剂、化肥和其他化学药剂的使用已经成为常规。有时候这些化合物会污染家畜和家禽及其饲料，因此制定一套评价人类食品安全风险和管理措施的系统是十分必要的。通过引用提交到美国食品动物残留物控制数据库（FARAD）的案例，本次讲座将会回顾如何获取和对污染案例提出建议。讲座讨论的内容有：案例的发展历史、暴露量的估计方法、耐受性鉴定、最大残留物水平或作用水平、发表或未发表的研究数据搜索，以及表达恰当休药期或检测项目的建议。

A Brave New World: Mitigating Antibiotic Usage in Poultry Production

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UC Davis School of Veterinary Medicine, Cooperative Extension

It is difficult to overemphasize the significance of the fast food chicken company Chick-fil-A's announcement regarding sourcing only chicken meat from birds that were not treated with antibiotics. This type of commercial change coupled with complementary federal regulatory changes are changing how large-scale poultry production is done in North America. This is primarily in response to the general conclusion that the use of antimicrobials in medicine and agriculture is considered the most important factor contributing to antimicrobial resistance. This talk will focus on surveillance data from farm to market with respect to the isolation and characterization of antibiotic resistant bacteria isolated from poultry products. In addition, trends in the incidence of antibiotic usage and corresponding resistance incidence rates will be highlighted in parallel with regulatory milestones including the banning of enrofloxacin in poultry and the recently passed Veterinary Feed Directive which attempts to mandate how medically important antibiotics given to food animals are used and distributed. Other topics including the transition to Whole Genome Sequencing (WGS) will be used to show how next generation sequencing technologies will be integral toward developing a new epidemiological paradigm in antimicriobial resistance monitoring in foods.

一个勇敢的新世界：减少抗生素在家禽生产中的使用

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速食鸡肉公司 Chickfil-A 宣告他们只使用未经抗生素治疗的禽类作为原料来源，而太过强调这件事的重要性却比较困难。这种与联邦管理规定变化同时出现的商业变化，正改变着北美地区的大规模家禽生产方式。这主要是针对一个普遍的观点的回应：医学和农业上抗菌药的使用是造成耐药性的最重要因素。基于从家禽产品中分离得到耐药细菌的分离方法与特性描述，本次报告将重点关注从农场到市场范围所获得的监控数据。另外，抗生素使用率与相应抗性发生率的变化趋势，将与里程碑式的监管条例被共同强调，后者包括在家禽中禁用恩诺沙星和近期通过的兽药饲料指令，即尝试控制食品动物中重要抗生素的使用和分布方式。其他话题，包括向全基因组测序（WGS）的转变，将被用来展示在食品的抗生素耐药性监控方面，下一代基因测序技术是如何整合成为一个全新的流行病学模型的。

Connecting the Dots: Using Novel Epidemiological Approaches to track *Salmonella* in Live and Processed Poultry

Maurice Pitesky DVM, MPVM, ACPVM
UC Davis School of Veterinary Medicine, Cooperative Extension

Salmonella contamination of grow-out poultry destined for human consumption can occur from multiple sources in the broiler supply chain. Understanding specific on-farm and processing risk factors that positively and negatively affect Salmonella prevalence at the processing plant is essential toward mitigating risk. This presentation will focus on the practical application of traditional and novel statistical approaches that facilitate producer engagement and empowerment in the analysis of the results. Traditional statistical approaches include Pearson's correlation coefficients and multiple logistic regression models using the statistical program R to improve data visualization and hence empower producers in decision making. Novel approaches include Random Forest and Conditional decision trees which offer a powerful novel approach toward risk analysis of multiple interventions in poultry production. Using the above described models in parallel offers a comprehensive approach toward evaluating risk of Salmonella in live and processed chicken.

联系各点：用新颖的流行病学方法追踪活禽和加工禽类中的沙门菌

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用于人类食用的成年禽类发生的沙门菌污染，可能源于肉鸡供应链的多种途径。了解详细的农场中和加工过程中的存在风险因素，包括或积极或消极地影响沙门菌在加工厂中流行的因素，对降低风险十分重要。这个讲座将关注传统的和新颖的统计学方法的实际应用，它们有利于生产者参与并享有结果分析的权利。传统的统计学方法包括皮尔森相关系数和多元逻辑回归模型，而使用统计程序 R 能够提高数据可视化，因此生产者享有了决策权。新方法包括随机森林和条件决策树，它能够提供家禽生产中新颖强大的多重干预风险分析方法。平行地使用上述方法，就能够获得全面地评估活禽和加工禽类中出现沙门菌的风险。

California's Diagnostic Laboratory System and Testing to Monitor Products for Assuring Safe Food/Dairy Products

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The California Animal Health and Food Safety Laboratory System (CAHFS) is the early warning system for California animal agriculture. CAHFS plays a leading role in assuring that animal products intended for human consumption are safe to eat. This role is fulfilled through animal disease diagnosis and both microbiological and toxicological testing of animals and animal products. CAHFS oversees the State of California's milk quality laboratory and has one the best equipped analytical toxicology laboratories in the United States. The Toxicology Section of CAHFS is a member of two national laboratory networks that are designed to protect human (Food Emergency Response Network or FERN) and animal foods/feeds (Veterinary Investigation and Response Network or Vet LIRN). Making sure that animal feeds are free of contamination is critical since any animal feed contamination has the potential to contaminant animal products intended for human consumption. The relationship between CAHFS and the California Department of Food and Agriculture as well as the two national laboratory networks will be discussed and case examples provided. General analytical approaches to the detection of a broad range of potential contaminants will also be considered.

加利福尼亚诊断实验室系统和保证食品/乳制品安全的产品监控测试方法

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加利福尼亚动物健康与食品安全实验室系统（CAHFS）是加州畜牧业的预警系统。CAHFS 在为人类消费者提供安全可食的动物产品方面起着主导作用。完成这一角色需要进行动物疾病诊断，以及动物、动物产品的微生物和毒理学检测。CAHFS 监测加州的牛奶质量，并且有一个全美设备最好的毒物分析实验室。CAHFS 的毒物分析部门包括两个致力于保护人类（食品紧急事件应对网络，FERN）和动物食物/饲料（兽医调查和反应网络，Vet LIRN）安全的实验室网络。确保动物饲料不受污染十分关键，因为任何动物饲料的污染都会产生潜在污染的用于人类消费的动物产品。CAHFS 与加利福尼亚食品和农业部门，以及这两个国家实验室网络间的关系将被讨论，还会展示一些实例案例。CAHFS 检测广泛的潜在污染物的一般分析方法也被考虑在内。

Environmental Toxicology and Implications for Food Safety

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Many man-made and naturally occurring substances can potentially contaminate animal and human food and water supplies. In animal agriculture, chemical contamination of animal products intended for human consumption can occur through the intentional or unintentional inclusion in animal feed and water sources, through direct application to animals, or through their environment. Regulatory agencies have established acceptable concentrations for many chemicals in human food and water, but for the vast majority of chemicals, the default acceptable concentration is zero (i.e., any detectable concentration is not allowed). In order to effectively protect animal and human food and water supplies from contamination, rapid and sensitive diagnostic testing, both broad based and targeted, in a variety of sample matrices for environmental chemicals is essential. Examples of organic and inorganic environmental contaminants that have been of concern in a veterinary diagnostic setting will be discussed. Examples of organic contaminants include insecticides, perchlorate, and plant toxins such as oleandrin, while common inorganic contaminants include lead and mercury. Case examples will be discussed that illustrate analytical approaches, clinical impacts on animals, and regulatory concerns.

环境毒理学与对食品安全的启示

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很多人造的和自然产生的物质会对动物和人类的食物与水供应造成潜在污染。在畜牧业中，供人类食用的动物产品会在有意无意间受到化学污染，这些污染可能来自于直接供应给动物的，或存在于其环境中的动物饲料和水资源。管理机构已经颁布了很多化学物质在人类食物和水中的允许浓度，不过大多数化学物质的默认允许浓度是零（即任何检出浓度均被禁止）。为了有效地保护动物和人类的食品与水供应不被污染，对各种环境化学物质的样本模型建立快速而灵敏的诊断测试方法（既有广泛基础又有针对性）非常重要。兽医诊断设置中，有机和无机环境污染物的例子值得关注，而且将进行讨论。有机污染物的例子有杀虫剂、高氯酸盐和如夹竹桃甙等的植物毒素，而无机污染的例子有铅和汞。我们将讨论相关案例，并且阐明分析方法、动物的临床效果以及监管关注的问题。

The Importance of a Teaching Hospital for Preparing Students for Clinical Practice

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Although veterinary school graduates have seemingly limitless options for careers related to animal, human and environmental health, most will enter private practice, serving animal agriculture and, increasingly, companion animals, horses and non-domestic species. Unlike graduates of medical schools, veterinary graduates are licensed to practice unsupervised at the time of graduation and must, therefore, already possess a broad range of technical and non-technical competencies. It is therefore incumbent on veterinary schools to define and train their students in these competencies and document the proficiency of their students at or above a minimal "entry level" at the time of graduation. Although initial training in many of the requisite technical skills, such as sterile placement of an intravenous catheter in a dog, and non-technical skills such as client communication and clinical problem-solving, are best accomplished in a controlled classroom setting involving non client-owned animals, simulated models, or actors, development of true entry level proficiency typically requires multiple repetitions under "real world" conditions on client-owned animals under the supervision of skilled clinicians who have the time to devote to such training. Using UC Davis as a model, this presentation will highlight the tremendous value of the veterinary teaching hospital in preparing students for success in clinical practice.

教学医院对培养学生临床实践的重要性

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尽管看起来动物医学院的毕业生们在动物、人类和环境健康相关领域具有无限的职业选择，但是他们中的绝大多数会进入私人诊所，服务于畜牧业，以及越来越多的伴侣动物、马和非家养动物。不同于医学院的毕业生，早在毕业时，兽医毕业生就被允许且必须进行无人监督的实践，这使得他们具备了广泛的技术与非技术的能力。

因此，兽医院有责任对其学生进行这些技能的规范和培训，并记录在毕业时他们的熟练程度，是否达到或者高于"入门水平"。毕业生应掌握的必需技能包括技术性技能，如狗导尿管的无菌处理，和非技术性技能，如与客户沟通和处理临床问题等。尽管具有无主人的动物、仿真模

型或演员的可控的教室环境，是进行初始训练的最佳场所，要想真正掌握入门水平的熟练度，学生们仍然需要在真实情境下进行多次重复，而所谓的真实情境指的是在熟练的、愿意为这些训练付出时间的临床医生的监督下，对有主人的动物进行操作。本次演讲将以加州大学戴维斯分校为例，突出兽医教学医院在培养合格的临床实习生方面具有的巨大价值。