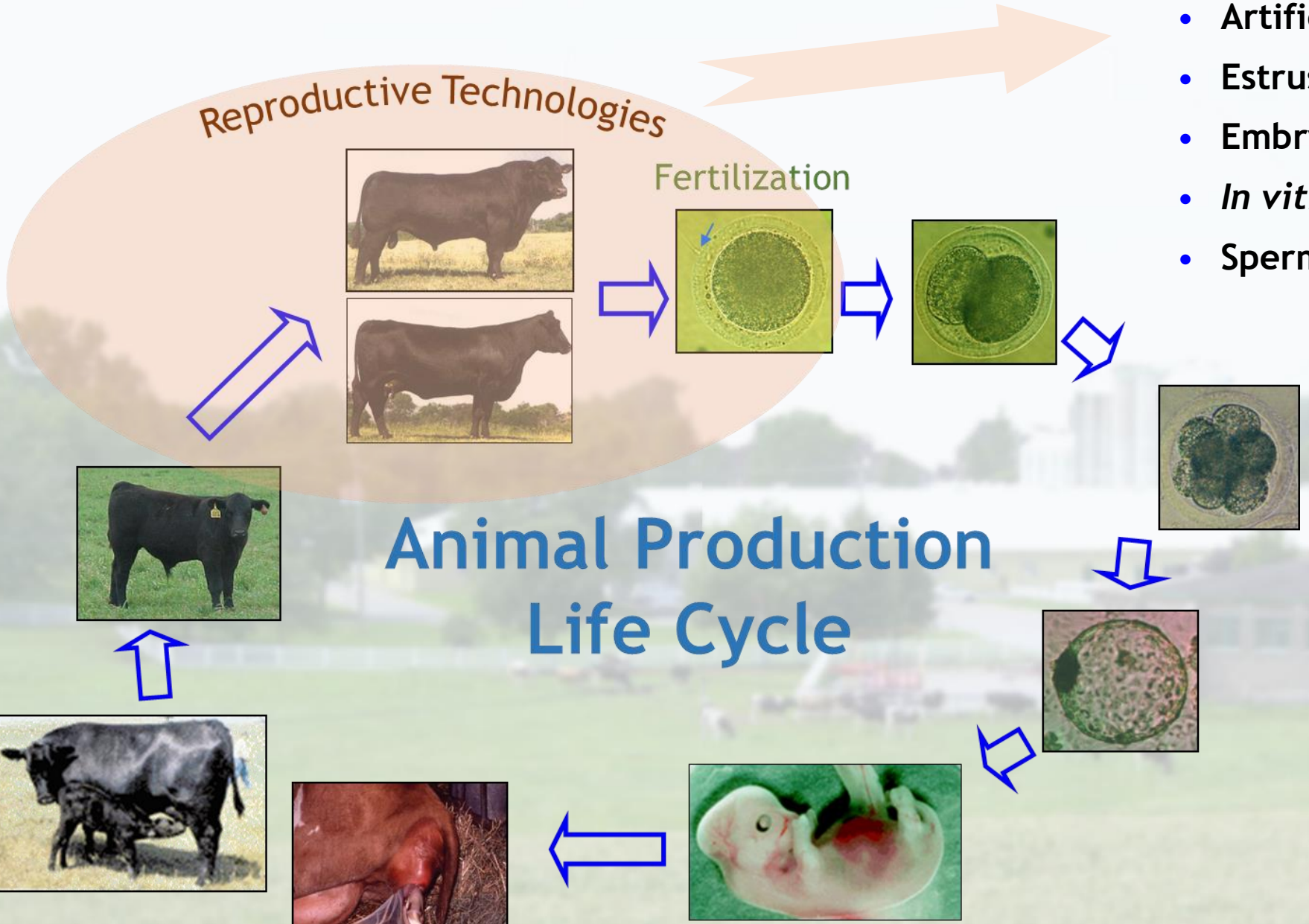
Animal Production Life Cycle

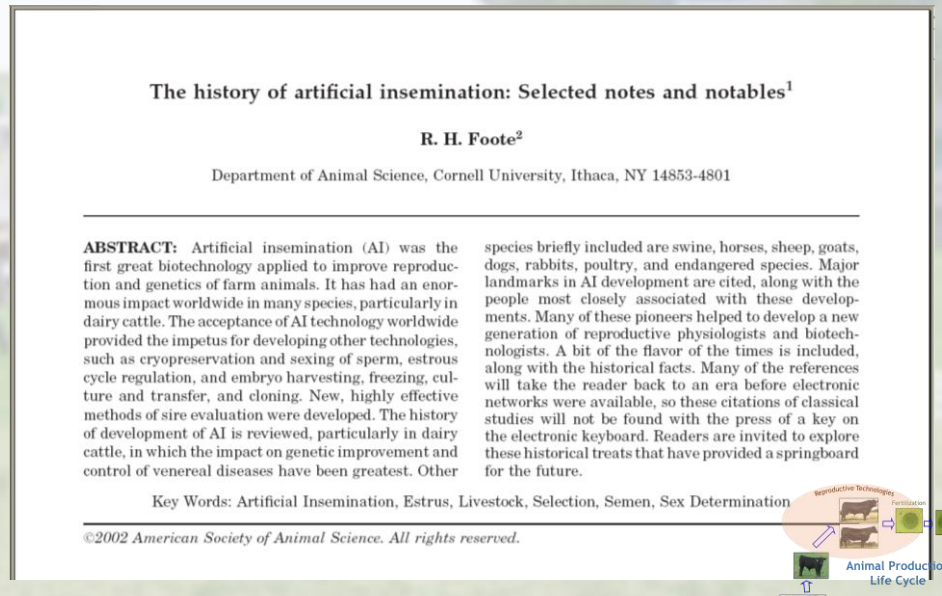


- Artificial Insemination (AI)
- Estrus synchronization
- Embryo transfer (ET)
- *In vitro* embryo production (IVP)
- Sperm/embryo sexing

History of Artificial Insemination

- Arab Chieftains 1300s
  - Stole semen to breed mares
- Leeuwenhook - 1677
  - Used microscope to see sperm
- Spallenzani - 1780
  - Experiments with dogs demonstrated that sperm could fertilize
  - Cooling and freezing inactivated sperm and upon warming sperm were reactivated (1803)
- Ivanov (Russia) - 1900
  - Developed methods as we know today
  - Most work was with horses (!) but did some cattle and pig work also
- Denmark - 1936
  - First dairy cooperative (102 members; 1,050 cows inseminated)
- First US AI Cooperative in New Jersey - 1937
- Dairy cooperatives increase in numbers - 1940's and 1950's
- Dairy cooperatives merge to form large companies that dominate cattle AI industry - 1960's to present
- Turkey's almost exclusively bred with AI - 1960's to present
- Expansion of swine AI - 1990's
- Expansion of horse AI - 1990's.

"the placing of sperm in the reproductive tract of a female by artificial techniques rather than by the natural breeding process"



The history of artificial insemination: Selected notes and notables[1]

R. H. Foote[2]

Department of Animal Science, Cornell University, Ithaca, NY 14853-4801

ABSTRACT: Artificial insemination (AI) was the first great biotechnology applied to improve reproduction and genetics of farm animals. It has had an enormous impact worldwide in many species, particularly in dairy cattle. The acceptance of AI technology worldwide provided the impetus for developing other technologies, such as cryopreservation and sexing of sperm, estrous cycle regulation, and embryo harvesting, freezing, culture and transfer, and cloning. New, highly effective methods of sire evaluation were developed. The history of development of AI is reviewed, particularly in dairy cattle, in which the impact on genetic improvement and control of venereal diseases have been greatest. Other species briefly included are swine, horses, sheep, goats, dogs, rabbits, poultry, and endangered species. Major landmarks in AI development are cited, along with the people most closely associated with these developments. Many of these pioneers helped to develop a new generation of reproductive physiologists and biotechnologists. A bit of the flavor of the times is included, along with the historical facts. Many of the references will take the reader back to an era before electronic networks were available, so these citations of classical studies will not be found with the press of a key on the electronic keyboard. Readers are invited to explore these historical treats that have provided a springboard for the future.

Key Words: Artificial Insemination, Estrus, Livestock, Selection, Semen, Sex Determination

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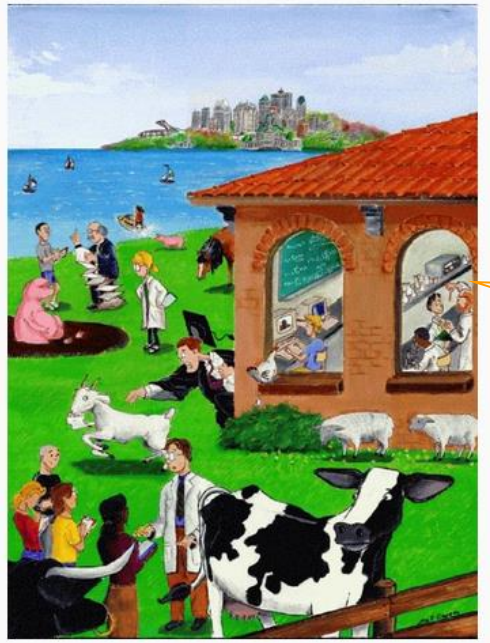
Principles of Animal Science



Principles of Animal Science

- Course Information
- Lectures and Labs
- Something to think about...

Kevin Wade

MS1-083

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Overview

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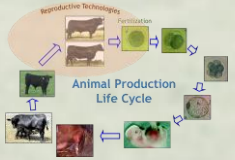
- The paradox of lecture notes...
- Making safe, affordable and abundant food a global reality by Simmons
- The Estrous Cycle...
- The History of Artificial Insemination...
- The *Real* Dirt on Farming (may have to right-mouse click --> open in new tab)
- The Canadian Pork Story...

Print Download

Advantages of AI…

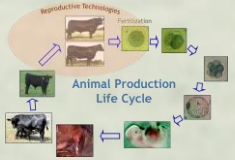
- Possible increases in fertility
- Increases genetic gain of economic traits by maximizing the use of superior sires.
  - Milk-production traits…
  - Meat-production traits…
- Allows use of superior males without the cost /responsibility of ownership.
  - Safety Issues…
  - Decrease in breeding expenses
- Reduces the chance of transmitting diseases.
- Allows the concentration of the breeding period (heat synchronization):
  - many females can be bred at once, vs. “natural” breeding with 1 male.
- Facilitates crossbreeding.



Steps involved in a successful AI process…

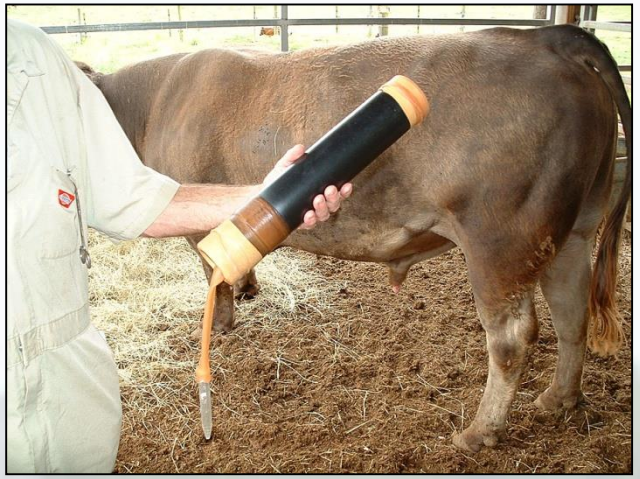
- Semen collection
- Semen evaluation and processing
- Heat (Estrus) detection
- Insemination (semen deposition)

Depending on the species, only some of these stages may be under the control of the producer



Semen Collection

- Artificial vagina (~45° plus lubricants)
  - bull, stallion, ram, buck
- Digital manipulation
  - boar, dog
- Electro ejaculation (libido problems)
  - bull, ram, buck, dog

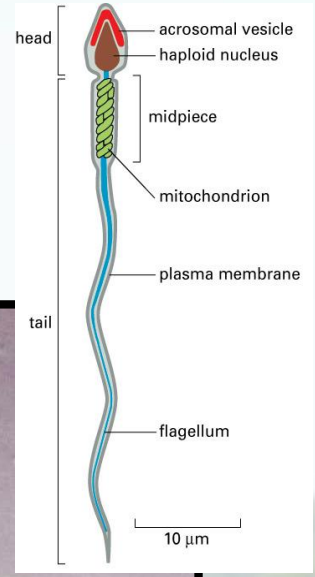


Artificial vagina

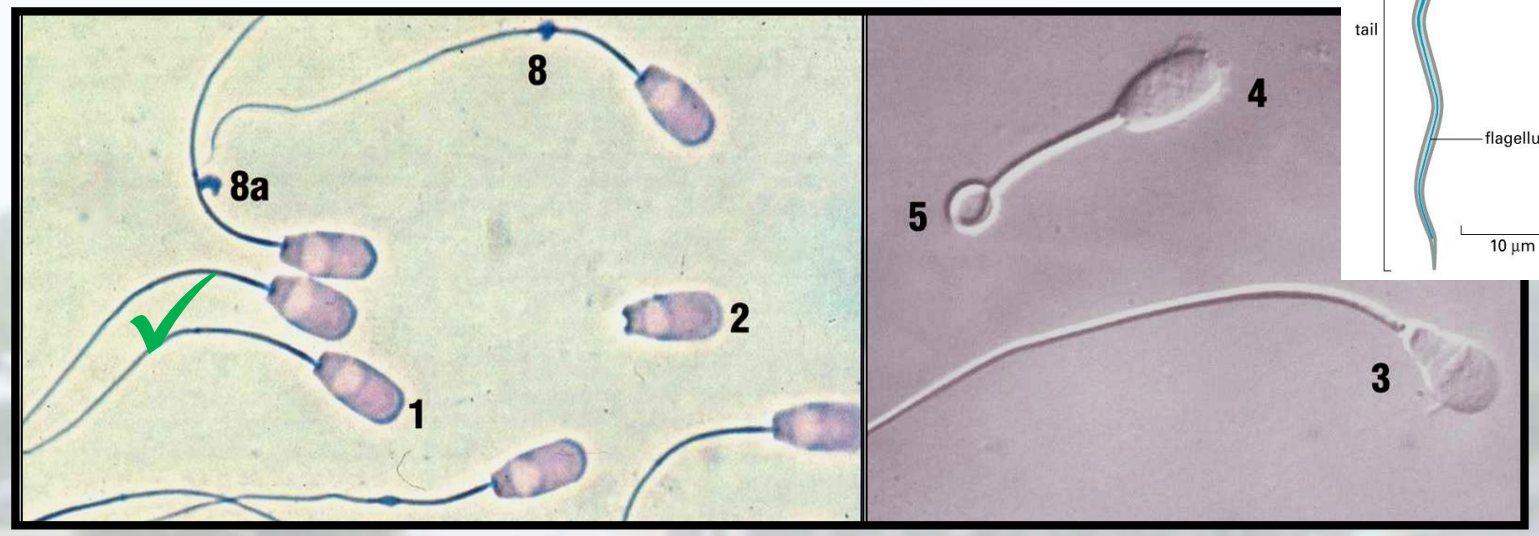
Electroejaculator

Semen Evaluation

(Quantity and Quality!)



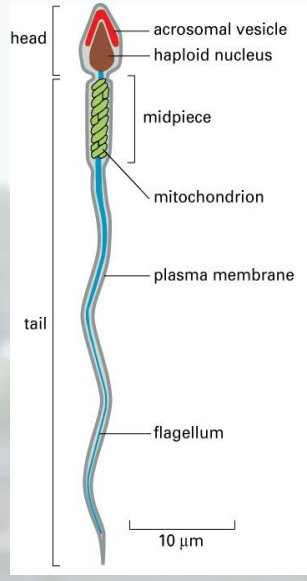
- Volume
- Sperm concentration
- Sperm viability
  - motility (> 70% movement)
  - morphology (> 70% normal)

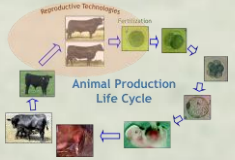


1 - normal, 2 - loose normal head, 3 - abnormal head, 4 – abnormal head and acrosome, 5 - strongly coiled tail, 8 and 8a - distal droplet

Semen Extension and Cryopreservation

- Fresh semen
  - Buffered extender
- Frozen semen
  - Buffered extender
  - Membrane stabilization
  - Cryoprotection





Estrus (heat) detection

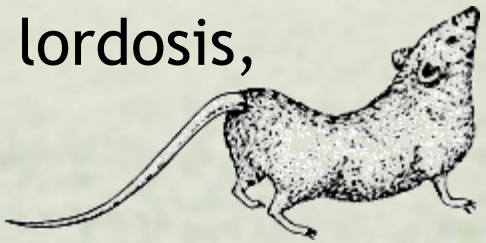
Signals time of ovulation (must be accurate)

Cattle: stand for mounting by other females or male, clear mucus discharge

Ewe/Doe: stands for ram/buck

Mare: during teasing with stallion, will stand, urinate and contract the vulva ("winking of the vulva")

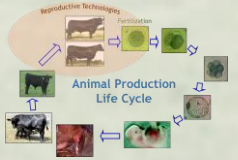
Swine: stands (back-pressure test) exhibits lordosis, ears often erect



Insemination Site and Techniques

- **Cow**
  - Intra-uterine via rectal manipulation
- **Ewe/Doe**
  - Intra-cervical or intra-uterine using a vaginal speculum and a laparoscope

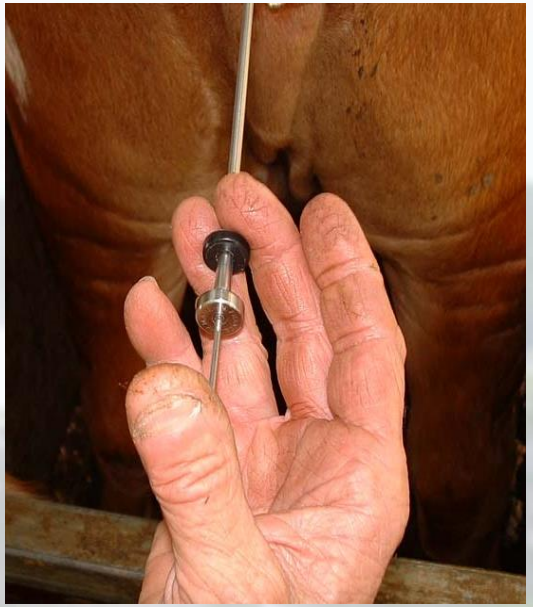
- **Mare**
  - intra-uterine via a pipette manually past the cervix
- **Sow**
  - deep cervical using specially adapted pipettes (spiral)



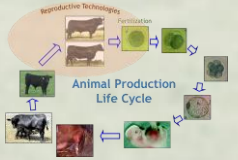
Artificial Insemination in Cattle

Clean the exterior/vulva

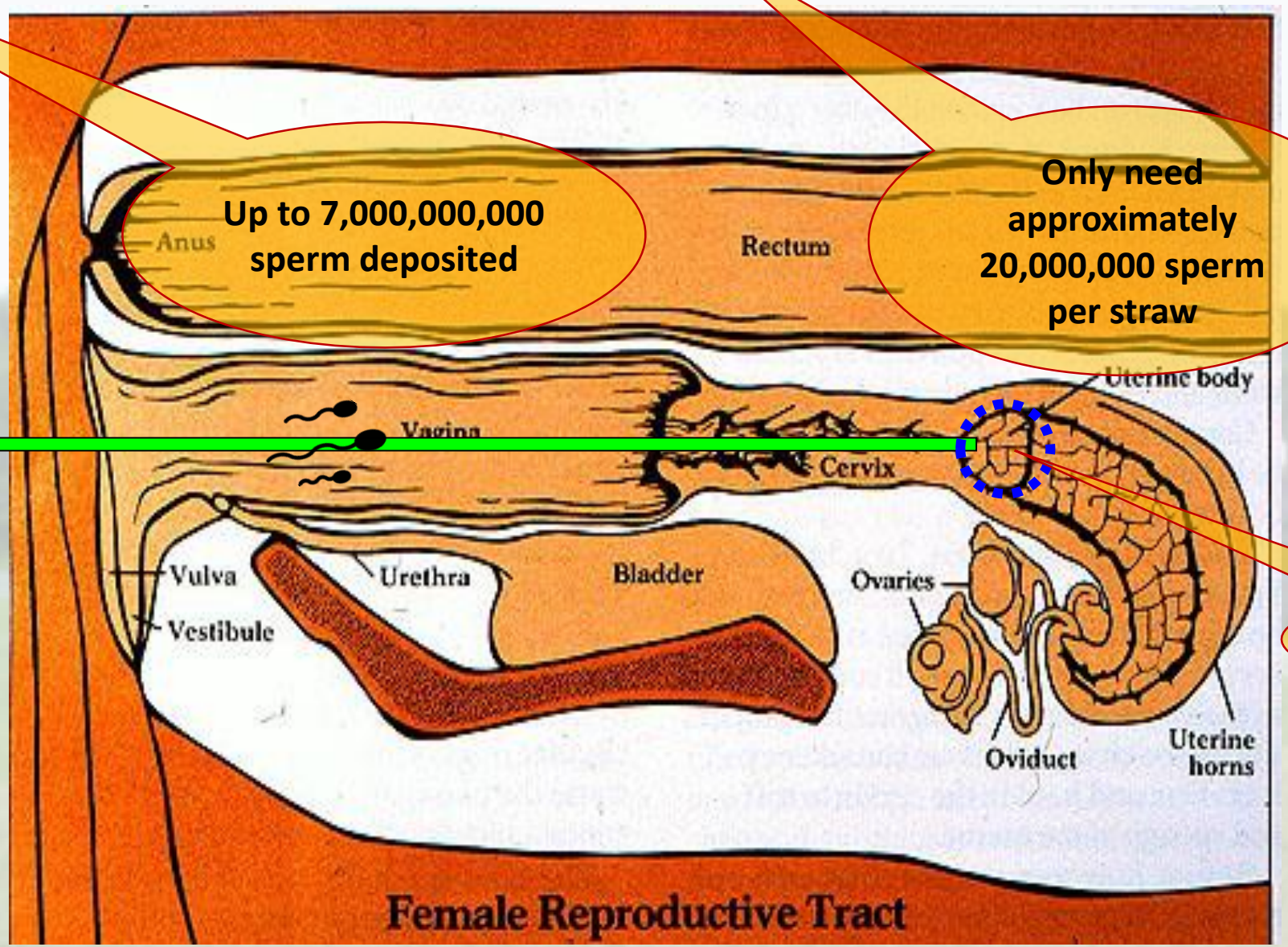
Locate the cervix



Insemination gun (rod) is passed through the cervix and the semen is deposited into the body of the uterus



Natural Insemination versus Artificial Insemination in Cattle…



Up to 7,000,000,000 sperm deposited

Only need approximately 20,000,000 sperm per straw

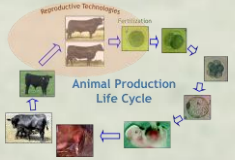
This is why we deposit semen directly into the body of the uterus

Vagina to Uterine Body…

probably < 1 hour !

Insemination times

- **Cattle**
  - 12 hours after the beginning of the estrus (stand for mounting)
- **Sow**
  - 12 to 24 hours after the beginning of the estrus, repeat 12-18 hours later (can be repeated again another 12 hours later)
- **Ewe**
  - 12 hours after the beginning of the estrus
- **Doe**
  - 24 hours after the beginning of the estrus
- **Mare**
  - Every 2 days from the second day of estrus (fresh semen) or every day (frozen semen)

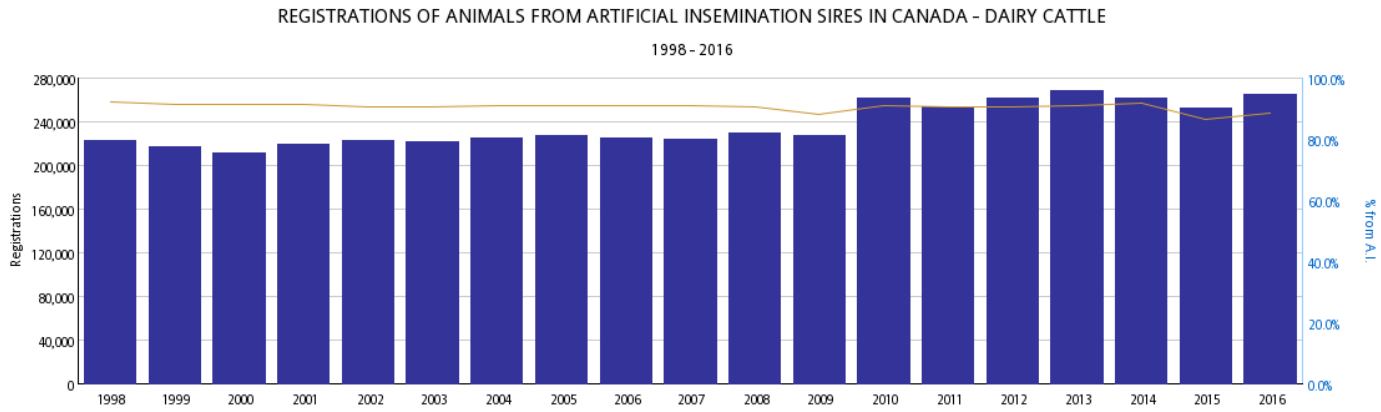


REGISTRATIONS OF ANIMALS FROM ARTIFICIAL INSEMINATION SIRES IN CANADA - DAIRY CATTLE

1998 - 2016

	Ayrshire	Brown Swiss	Canadienne	Guernsey	Holstein	Jersey	Milking Shorthorn	Total[1]	% from A.I.
2016	5,293	-	183	204	251,013	8,452	-	**265,145**	**88.6%**
2015	6,232	-	282	-	238,529	7,790	-	**252,833**	**86.6%**
2014	6,079	1,023	221	211	246,749	7,029	193	**261,505**	**91.6%**
2013	5,185	836	208	172	253,502	7,876	239	**268,018**	**91.1%**
2012	5,194	834	301	192	246,595	7,769	245	**261,130**	**90.4%**
2011	5,992	794	196	205	238,498	7,472	170	**253,327**	**90.4%**
2010	6,076	942	224	237	246,865	7,161	212	**261,717**	**90.9%**
2009	6,525	1,215	209	235	211,531	7,340	200	**227,255**	**88.0%**
2008	6,429	1,278	177	204	214,213	6,572	202	**229,075**	**90.7%**
2007	6,393	1,279	183	213	208,867	6,337	191	**223,463**	**90.9%**
2006	6,783	1,273	247	249	210,421	6,103	169	**225,245**	**90.7%**
2005	6,778	1,648	225	274	211,997	5,746	136	**226,804**	**90.9%**
2004	6,423	1,089	148	262	211,806	5,621	120	**225,469**	**90.8%**
2003	6,458	1,154	114	307	207,321	5,610	144	**221,108**	**90.7%**
2002	6,500	738	154	407	207,730	6,518	162	**222,209**	**90.4%**
2001	6,030	1,110	135	336	205,840	5,349	124	**218,924**	**91.5%**
2000	6,754	830	77	377	197,116	5,862	278	**211,294**	**91.3%**
1999	6,442	864	60	542	202,529	6,991	-	**217,428**	**91.5%**
1998	6,971	930	127	646	207,950	5,902	-	**222,526**	**92.3%**

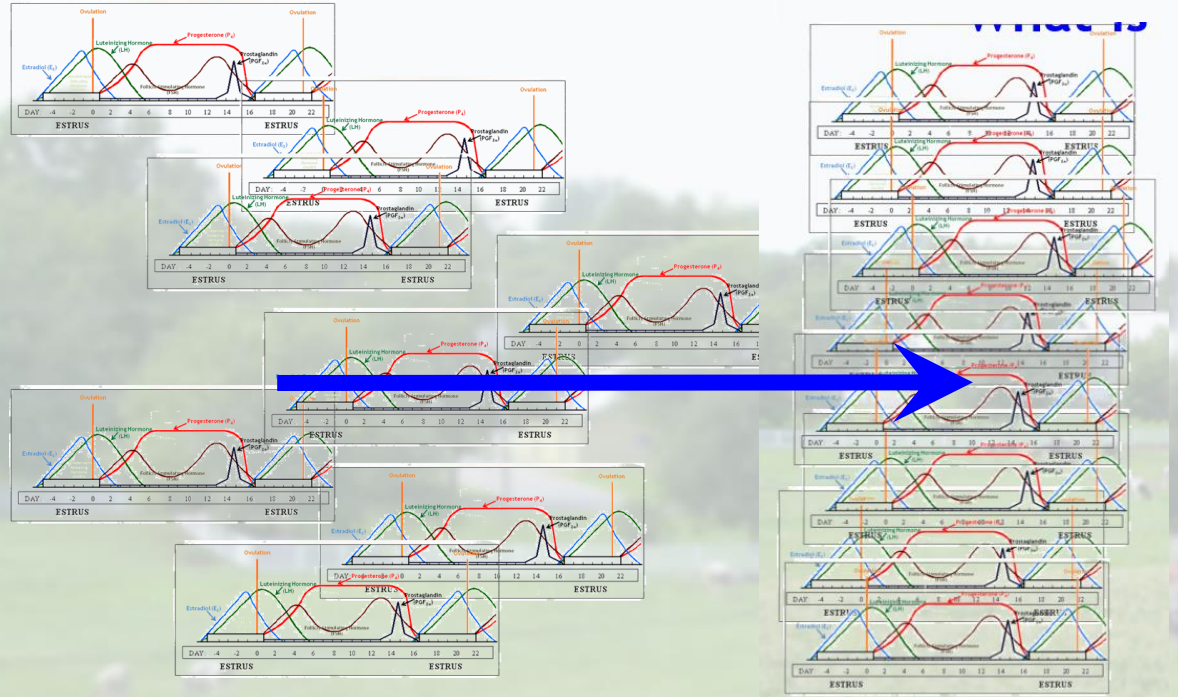
90%



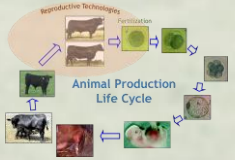
-: Nil or Not Available
1: Includes percentage animals (not 100% purebred)
Source: Breed associations and Canadian Livestock Records Corporation
Calculations done by AAFC-AID, Market Information Section
Printed: Sep 29, 2017 11:36:10 AM
AIMIS

http://www.dairyinfo.gc.ca/index_e.php?s1=dff-fcil&s2=mrr-pcle&s3=dcr-ebl

Estrus Synchronization - (Controlling the Breeding Time)
What is it? and Why do it?



- Improve reproductive performance
- Improve efficiency of heat detection
- Control timing of first service postpartum
- Fixed time AI
- Shortened breeding season (beef cattle, sheep)
- Shortened calving/lambing season (beef cattle, sheep)
- Concentrate labour needs to certain times (beef cattle, sheep)



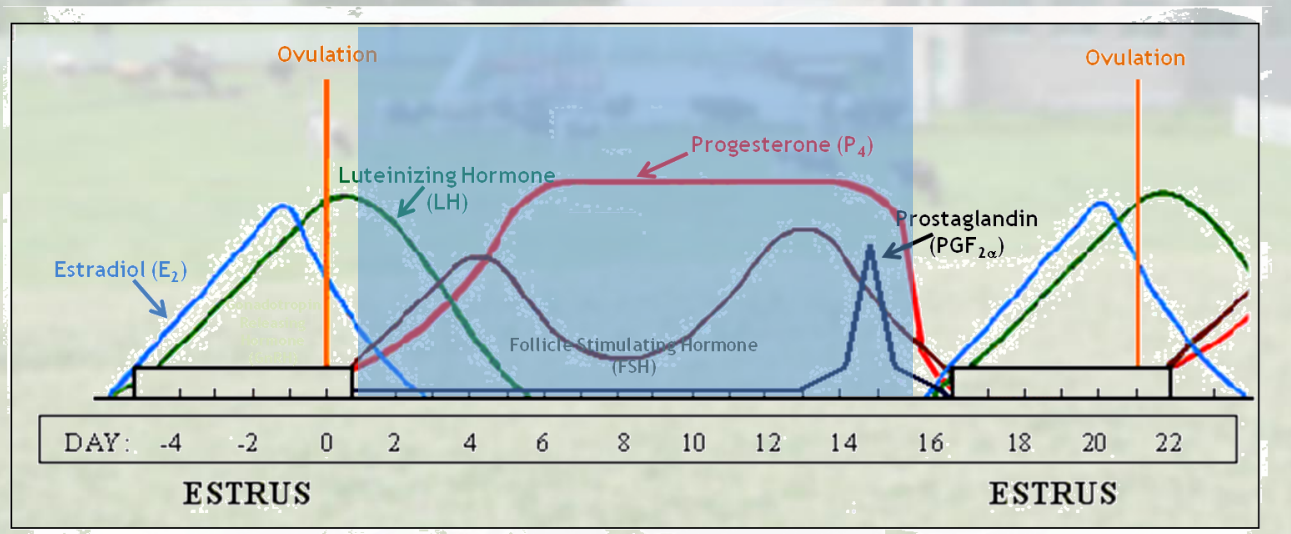
Principles of estrus synchronization

(manipulating the **luteal** phase – i.e., when the corpus luteum is active)

Prolong the Luteal Phase

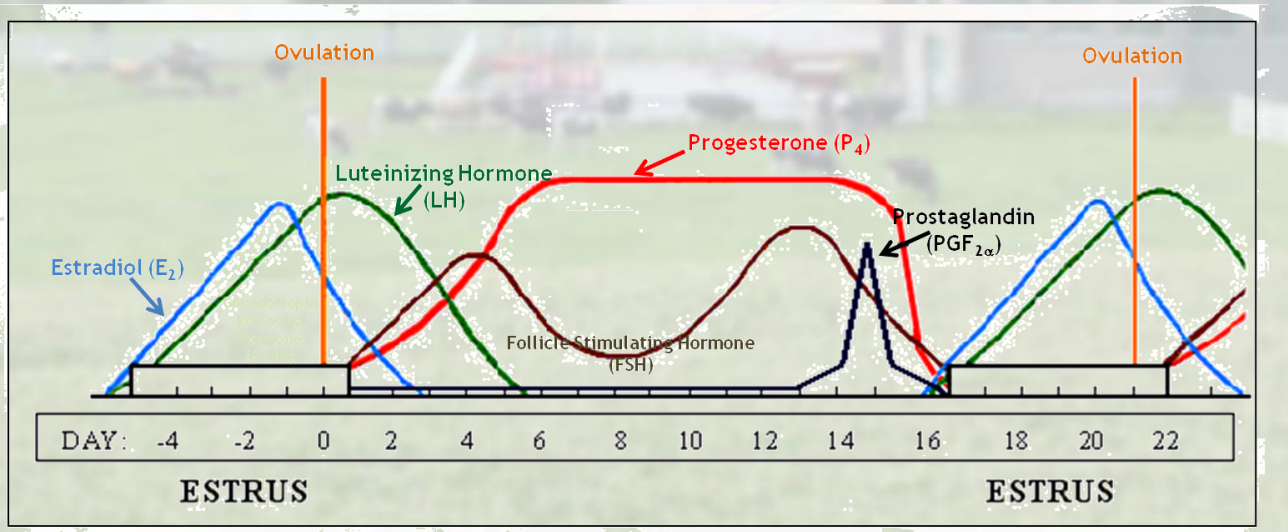
or

Reduce the Luteal Phase



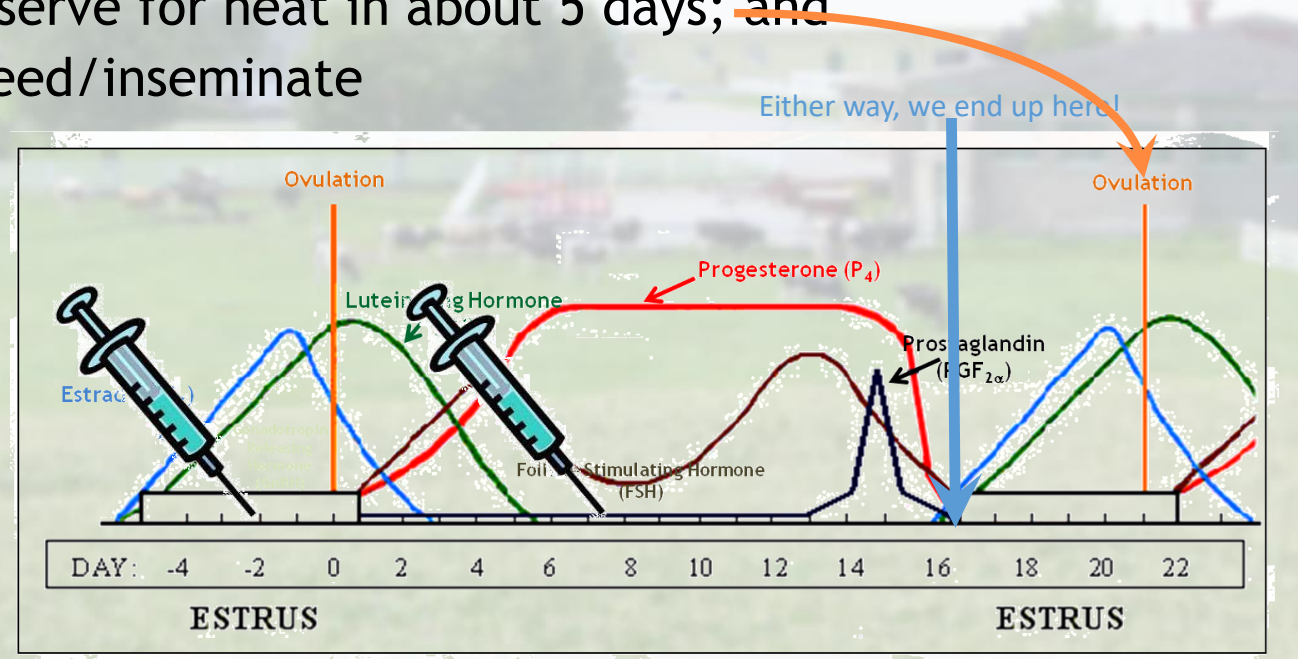
Prolonging the luteal phase (Progesterone)

- Artificially *extend* luteal phase by introducing Progesterone and allow for natural luteolysis (i.e., degradation of the Corpus Luteum)
- Just to be sure, give Prostaglandin prior to removal of the Progesterone source (to ensure luteolysis)



Reducing the luteal phase (Prostaglandin)

- Effective only if Corpus Luteum is mature
- Palpate corpus luteum and inject Prostaglandin
  - two shots 14 days apart
    1) observe for heat in about 5 days; and
    2) breed/inseminate



A few words on Quiz 1

- 2-hour Quiz
- Accessible to begin any time on Wednesday Sept 30 (Montreal time)
  - A 24-hour period
  - 12:00 AM EDT (GMT-4) to 11:59 PM EDT (GMT-4)

- 20% of Grade (100 points)
- Access to myCourses material
- Material covered up to September 23 (today)
- Mixture of short questions
- And Longer questions…

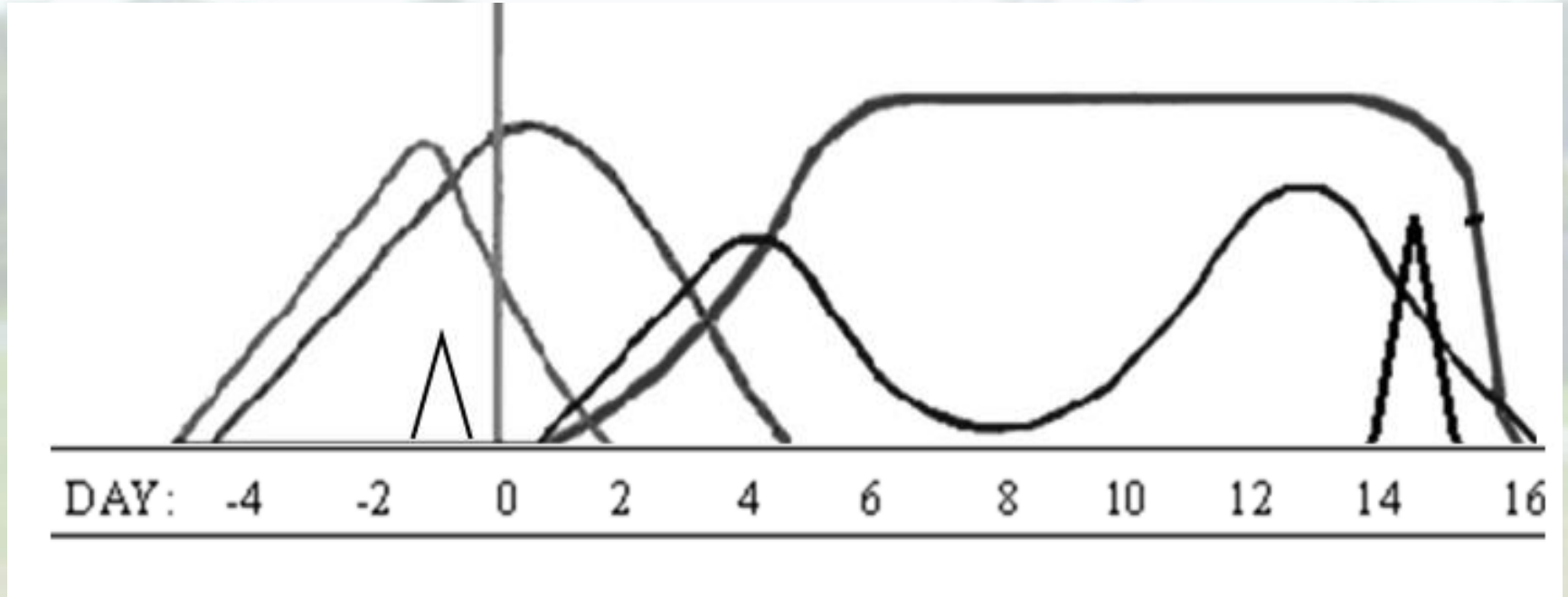
Check all the statements that are true, and leave the false statements blank.

+1 for each correct choice;-1 for each incorrect choice. But total mark cannot be negative.

(i.e., All correct = 5 points; four correct = 3 points; three correct = 1 point; and one or two correct = 0 points)

- [ ] 1. Use of recombinant bovine somatotropin (bST) increases a cow's milk production by almost 30%
- [ ] 2. Recombinant bovine somatotropin (bST) is legal throughout North America for increased milk production in dairy cows
- [ ] 3. The only Canadian dairy herds *not* allowed to use recombinant bovine somatotropin (bST) are certified organic-milk herds
- [ ] 4. Milk, from cows treated with recombinant bovine somatotropin (bST), is considered a GMO
- [ ] 5. Dairy products in Canadian stores do *not* contain recombinant bovine somatotropin (bST)

Label the Diagram…



Fill in the blanks…

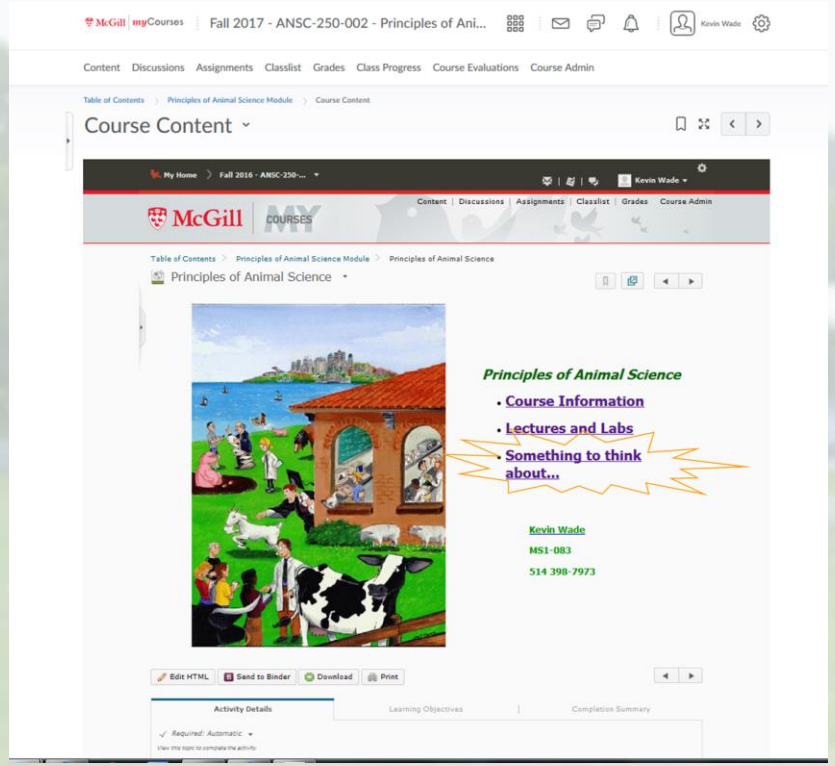
Fill in the blanks using terms from the following list: ***Cow***, ***Sow***, ***Ewe***, ***Doe***, and ***Mare***. Terms *can* be repeated.

Both the SOW and the DOE ovulate approximately every 21 days and estrus can last for up to 3 days in length.

Gestation length in both the EWE and the DOE or SOW is less than 6 months but the length of their cycles is quite different.

Even though the length of their cycle is usually the same, the COW or SOW is polyestrous while the DOE is seasonally polyestrous.

Discuss…




'Natural' orange juice caught in scientific and linguistic squeeze

JOE SCHWARCZ
THE RIGHT CHEMISTRY

We all have habits. One of mine is to start every day with a glass of orange juice. Freshly squeezed would be ideal, but frankly too much of a bother. So I go for the one that says "100% pure and natural, nothing added, nothing taken away, just oranges." My preference has nothing to do with the "pure" or "natural," I have to do with taste. But I certainly took note when I came across a report that a class-action lawsuit had been launched in the U.K. against my favourite juice, Tropicana. What the issue had been uncovered, I wondered? Actually none.

The lawsuit asserts that the label claim "100% pure and natural" is false because the juice is in fact heavily processed and its flavour is scientifically manipulated. That being the case, the plaintiffs allege that they would not have purchased the juice, or paid more than they otherwise would have been willing to pay, had the juice been properly labelled. While this lawsuit has a frivolous flavour, it does bring the discussion of the term "natural" into the public arena. That's a good thing, because this expression is widely handled about in a meaningless fashion in order to cater to the common fallacy that "natural" is always superior to "processed," "artificial" or "synthetic."

There is no question that the image projected by Tropicana is that of oranges being squeezed and their juice poured into a carton for speedy delivery to a store near you. But that is not what happens. The truth is that if you want fresh, great-tasting orange juice, there is only one way to get it. Squeeze the oranges yourself and drink the juice as quickly as possible. Why quickly? Because the squeezing process unleashes a cavalcade of chemical reactions, most of which are not favourable. Enzymes released from the ruptured cells catalyze reactions between oxygen in the air and some of the hundreds of compounds that occur naturally in orange juice. The oxidized products result in off-flavours. If orange juice from a carton is to be fresh-tasting, these reactions have to be curtailed, which is why Tropicana has been working since the 1950s on various technologies to maintain as much of the original flavour as possible. And on ways to ensure that the juice contains no harmful bacteria.

Like virtually all foods, oranges can harbour bacteria. Pasteurization, basically heating the juice, kills bacteria, but it also kills taste. So, unpasteurized juice may appeal to the taste buds but sadly there have been well documented cases of poisoning from such juice, with perhaps the most famous one being in an Orlando theme park where more than 60 people came down with salmonellosis. How then do you get rid of bacteria and preserve the taste? Back in 1952, Anthony Rossi, who founded the company that would eventually become Tropicana, introduced a flash pasteurization process that managed to preserve the flavour by raising the temperature of the juice for only a very short time.

Pasteurization is critical since oranges are seasonal and juice sometimes has to be stored as long as a year to satisfy consumers who like to start off each day with this beverage. And why stonkin' they? It is a great source of potassium and provides a large array of antioxidants. But of course there's also a large dose of sugar, comparable to soft drinks, so we don't want to be gunning GU by the litre.

Orange juice from frozen concentrate was already available in the 1940s, but its taste was far removed from that of fresh oranges because the heat treatment needed to concentrate the juice resulted in the breakdown of flavour compounds as well as in the formation of novel compounds with undesirable characteristics. Development of Rossi's flash pasteurization was followed by the introduction of "de-aeration," a process by which a vacuum system removes much of the air from the freshly squeezed juice to prevent oxidation reactions. Unfortunately this also removes some of the natural orange flavours. But there was a scientific solution to this as well. The answer was to add flavour packs with orange oil extracted from the peel, sometimes added back to the juice.

The volatiles and orange oil make for a very complex mix of hundreds of compounds that can be separated from each other by techniques such as distillation and chromatography. A chemist can then assemble these into "flavour packs" with varying tastes. One of the major components responsible for fresh orange taste is ethyl butyrate, so flavour packs that contain higher levels of this chemical are especially desirable. Since oranges differ in taste depending on their variety and the time of the year when they are picked, the use of flavour packs allows for uniformity of taste year round. Basically then, flash pasteurization, de-aeration and the blending of orange compounds into flavour packs allows for a juice that tastes as close as possible to freshly squeezed. But it isn't exactly "100% pure and natural," although that, to some extent, depends on the interpretation of these ambiguous terms.

Since all components of the juice do come from oranges, the juice can be called "natural." In common usage, however, "natural" has come to imply unprocessed, so in that way Tropicana is not natural. That, though, has nothing to do with the quality of the juice, which is excellent, as evidenced by its popularity around the world. The real problem is the golden aura with which the term "natural" has been anointed. If oranges picked in Florida were not squeezed and the juice packaged and shipped up north, you would be drinking truly "natural" orange juice, but chances are high that you would not enjoy the natural bacteria and natural oxidation products.

Technically, the plaintiffs in the lawsuit against Tropicana are correct, and perhaps the labelling should be changed. Indeed, why not emphasize the scientific ingenuity in overcoming the natural degradation of orange juice?

Here's my suggestion: "The best tasting orange juice that nature and modern science can deliver." Because it really is.

Joe Schwarcz is director of McGill University's Office for Science and Society (mcgill.ca/oss). He can be heard every Sunday from 3-4 p.m. on CJAD radio. joe.schwarcz@mcgill.ca


CITY
SATURDAY, AUGUST 10, 2019 MONTREAL GAZETTE A7

Cyberbullying by vegan activists stresses farmers

Being called 'rapists and poisoners' is taking its toll, psychologist says

STEPHANE BLAIS

Cyberbullying by vegan activists is a growing source of stress for farmers and agricultural producers who already face significant mental health challenges linked to the job, a farmer and a psychologist working in the agriculture sector say.

Farmer Mylène Bégin, who co-owns Prince Farm in Quebec's Abitibi-Temiscamingue region, created an Instagram account a few years ago to both document daily life on the farm and combat what she calls "disinformation and the negative image" of agriculture.

Today, she describes herself as the target of bullying from vegan activists.

Bégin recently changed the settings on her account after having to get up an hour early to delete more than 100 negative messages a day — some of which made her fear for her safety, she said.

There was one that took screenshots of my photos. He shared them on his feed after adding knives to my face and writing the word 'psychopath' on my forehead," the 26-year-old said. "It made me so scared."

She said some of the messages compared artificial insemination of cows to rape, while others used the words "kidnapping" and "murder" to describe the work of cattle breeders.

The problem, she said, is that many city people don't understand agriculture but become severe critics nonetheless.

"It affects you psychologically. It's very heavy even if we try not to read (the comments)," she said. "The population has become disconnected from agriculture. We all have a grandfather who did it, but today in the eyes of many people we're rapists and poisoners, and that's what hurts me the most."

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Pierrette Desrosiers, a psychologist who works in the agricultural sector, said bullying on the part of hardcore vegan activists on social media is a new source of stress for a growing number of farmers.

"At school, the children of farmers start to be bullied and treated as the children of polluters, or else the kids repeat what they see on social media and say breeders rape the cows (when artificially inseminating)," she said.

"It's now a significant source of stress for producers, and it didn't exist a year or two ago."

Some messages from vegan activists compare artificial insemination of cows to rape. Others use the words "kidnapping" and "murder" to describe the work of cattle breeders. GETTY IMAGES/FILES

Desrosiers, a farmer's daughter and wife, is critical of the communications strategy used by certain animals rights groups and vegan associations.

"They use words like 'rape' and 'murder' to strike the imagination," she said. "It's anthropomorphism," she added, referring to the attribution of human traits and emotions to animals and objects.

Beginning last year, the Standing Committee on Agriculture and Agri-Food spent several months studying the mental health challenges facing farmers, ranchers and agricultural producers.

The report, completed in May, found that farmers are vulnerable to mental health problems due to "uncertainties that put them under significant pressure," including weather and environmental challenges, market fluctuations, debt and paperwork.

"The isolation that many farmers experience and the stigmatization they sometimes face, particularly on social media, amplify this stress," the report stated.

Their recommendations included an education campaign to combat cyberbullying and threats against farmers, as well as updating the Criminal Code to include cyberbullying against groups of Canadians based on their job or place of residence.

Frédéric Côté-Boudreau, who recently completed a philosophy doctorate at Queen's University and who studies animal ethics, said he's a vegan who would like to see animals recognized as equal to humans. However, he said, the language used by some animal rights defenders on social media is "counterproductive" to the cause.

"I've rarely seen someone get convinced by this kind of divisive approach," he said.

"When we're told we're cruel, we're less receptive to what the other side is saying."

But while he believes a peaceful approach is a more effective way to grow the movement, he said he shares the activists' concerns and their strong emotions when faced with a society that appears to accept exploitation and violence toward animals.

His doctoral thesis defended the idea that animals should have the right to make choices, including where to live, who to develop relationships with and how to spend their days.

"We have ample scientific proof about the emotional life and capacity to suffer of animals," he said.

"It's well-demonstrated that being coldly mutilated, crammed together, not being able to move normally, not being able to develop healthy social relationships, we know that it has enormous psychological and physical impacts on animals."

The Canadian Press

SUSAN SCHWARTZ

Organic plant-based product for young children involved two years of development and three moms: a lawyer, a dentist and Katia Pacioretty

Necessity is the mother of invention, the adage goes, and when a Montreal mother of two couldn't find an alternative she considered suitable for her daughters once she stopped breastfeeding, she decided to develop her own organic plant-based milk called Bear Latte.

Delphine Bollot, a corporate lawyer by profession and a naturopath by vocation, was on maternity leave with her second daughter. She had breastfed for a long time, but knew that when the girls were at daycare, "I wanted them to avoid cow's milk, and there is almost nothing on the market to replace dairy milk."

In naturopathy consults with other new mothers, she saw that many shared her concern. What to do after breastfeeding? Nut milks such as cashew and almond milk are made mostly of water, and they often contain gums and additives she knew she did not want her girls drinking regularly. Besides, allergies make nut milks off limits at schools and daycares. More than 65 per cent of the population is lactose-intolerant, Bollot said, "and more and more studies show that dairy and meat can increase cancer risk, diabetes and cardiovascular problems."

The latest edition of Canada's Food Guide does away with traditional food groups and folds in milk, milk products and meat with other protein sources. It suggests also that Canadians choose plant-based protein more often.

Bollot, 37, created a homemade recipe for a plant-based milk featuring hemp and bananas, among other ingredients, and clients started to ask for it. She found a powerful blender like a Vitamix, it was impossible to get it liquefied and smooth enough to pour into a bottle or sippy cup. Inspired in part by the entrepreneurial spirit her father has always shown, she thought like an innovator: How could she try to find the ingredients she wanted for such a milk and have them made in a powder?

She reached out to a local manufacturer to help source the ingredients internationally and to do the necessary testing. "I knew the standards and nutritional values I was looking for," Bollot said in an interview after the product's recent soft launch. "I wanted only whole food ingredients and wanted it to be organic — nothing lab-made or extracted."

It would take nearly two years of research and development to create and perfect the product. Along the way, Bollot was joined by two other like-minded mothers: Montreal dentist Sophie Godbout, who has a son and a daughter, and Katia Pacioretty, whose husband, Mat Pacioretty, was at the time captain of the Montreal Canadiens. (He was traded last September to the Vegas Golden Knights.) The couple has four sons, ranging in age from seven months to five years.

Together, the three mothers co-founded the Montreal-based company The Latte Co.

"Going back to work, I had to stop breastfeeding, and there was nothing that worked for me and my values," said Godbout, 36. "I looked over everything, I tried a milk with dairy; I did not want a soy product. I wanted it to be organic. There was nothing — and so we created a milk for our children and for all parents who want something like it for their children."

Each of the flavours, at $29.99, "This is us as mothers trying to give our children the best possible nutrition."

So far they have launched two products that are intended to replace cow's milk or other followup formulas (infant formulas have expert-markets: Bebe Latte, designed for children aged 12 to 24 months, and Kiddo Latte, for kids 24 months and older. They're awaiting final approval from Health Canada on a product for six- to 12-month-olds. All are certified organic and gluten-free and contain no major allergens such as nuts or soy.

"I am a strong supporter of the entire concept," wrote Dr. David S. Mulder, H. Rocke Robertson professor of surgery at McGill University, former surgeon-in-chief of the Montreal General Hospital and longtime chief surgeon for the Canadiens, in a letter of support. "It provides a healthy alternative to soy- and dairy-based diets at a critical age in development."

The products can be purchased at thelatteco.com, well as and in a few Montreal stores, and will be available locally more widely in the next couple of months. Prices for pregnant women, breastfeeding mothers and athletes will follow, Bollot said.

At $49.99 for a 450-gram container that makes 16 servings, the product occupies a niche market. "It's not every parent who will buy this product," Bollot said.

Response from those who have tried it in the six weeks it has been on the market has been positive, she said. "The mothers are really happy."

Product ingredients include bananas, rice powder, hemp seed, kale, shiitake mushrooms, organic fermented rice, banana powder, peas, flax, broccoli, blueberries, sweet potatoes and sunflower seeds.

The product can be consumed as a drink or added to smoothies. Godbout has used it in energy balls she made for her kids as a snack.

"The best part is that a child will be getting 40 different whole foods in one serving," she said. "It's so important for parents to know their kids are getting proper nutrients that support growth and brain development."

Delphine Bollot, right, devised plans for a plant-based milk when she couldn't find an alternative for her daughters once she stopped breastfeeding. "I wanted only whole food ingredients and wanted it to be organic," says Bollot, who co-founded The Latte Co. with Sophie Godbout, left, and Katia Pacioretty. PHOTOS: THE LATTE CO.


Going back to work, I had to stop breastfeeding, and there was nothing that worked for me and my values.

Max and Katia Pacioretty with their four sons, from left, James, Evan, Max Jr. and Michael. The Latte Co. "is us as mothers trying to give our children the best possible nutrition," Katia says.


Reasoned arguments are missing from the debate over GMO

JOE SCHWARCZ
THE RIGHT CHEMISTRY

A recent French study that purports to show a link between the consumption of genetically modified corn and a variety of ailments, including cancer, was just the tasty morsel that critics of genetically modified foods hungered for. For many scientists, however, the study proved to be a source of indigestion.

To be sure, genetically modified organisms are a hot-button issue, especially with the looming prospect of California's Proposition 37 that would require labelling of foods that have any component derived from genetically modified crops. Emotions are already boiling over, with members of activist groups such as the ridiculously named Genetic Crimes Unit screaming about genetic crimes against humanity as they don bio-hazmat suits to block shipments of Monsanto's transgenic seeds. They are also fond of displaying a giant "fish-corn," implying that biotechnology companies are engaged in melding fish genes with corn genes. Absurd.

Mike Adams, the self-appointed "Health Ranger" who routinely floods the Internet with stupefying diatribes on his Natural-News website, goes even further. "I predict, but DO NOT CONDONE," he says, "scientists who conduct research for Monsanto being threatened, intimidated and even physically attacked ... an inevitable reaction to the unfathomable evil being committed by the GMO industry and its co-conspirators." Seems to me Adams is the evil one by implanting such ideas. There are indeed some very legitimate issues to be addressed about genetic modification, but proper intellectual discourse has no room for such inflammatory tirades from untethered scientific nobodies.

Mistrust and confusion are often the result of a lack of understanding of the science involved. So let's take a look at what the controversy, at least as it pertains to the French study, is all about.

The researchers aimed to explore the effects of consuming corn that is genetically modified to resist Roundup, Monsanto's popular herbicide. Such Roundup-resistant corn is unharmed when sprayed with glyphosate, the active ingredient in Roundup, while weeds wilt. This is of great advantage to growers because the technology makes weed-control easier and more effective, increases profit, and means less till-age is required. Before the introduction of glyphosate-resistant crops, it was common to use as many as 10 different herbicides, most of which had worse toxicological profiles than does glyphosate.

Glyphosate was discovered back in 1970 by John Franz while he was working at Monsanto. It works by inhibiting the plant enzyme EPSPS (5-enolpyruvylshikimate-3-phosphatesynthase, if you must know), which is critical for the synthesis of three essential amino acids: tryptophan, tyrosine and phenylalanine. These in turn are needed for protein synthesis and are also used to make a variety of compounds, such as phenolics, tannins and lignins, essential for plant life. If EPSPS is inactivated, the plant withers and dies.

Some microbes also rely on EPSPS for protein synthesis, and in 1985 researchers discovered that a strain of the common soil bacterium — Agrobacterium tumefaciens — is highly tolerant to glyphosate because its EPSPS is less sensitive to inhibition by glyphosate than the version found in plants.

By 1986, the bacterial gene that codes for this enzyme was isolated and soon inserted into the genome of soybeans, corn, canola, alfalfa and sugar beets, allowing fields to be sprayed with Roundup to eliminate weeds without affecting the crops. As a result, the genetic modification of crops has become the most rapidly adopted technology in the history of agriculture. But it has also unleashed a cavalcade of conspiracy theories.

There are concerns about seed companies establishing strict criteria for the use of their seeds by farmers; there are questions about weeds developing resistance; and of course there are worries about safety. While the majority of scientists familiar with the technology were satisfied that the concerns had been properly addressed, there were some who thought that regulatory agencies had jumped the gun. One of these was Gilles-Éric Séralini, lead author of the current controversial study.

Séralini has written several anti-GMO books and has published other papers that claim to show adverse effects attributed to GMOs. He is vocal activist and has already been chastised by the European Food Safety Association for improper analysis of data. His present study involved feeding various combinations of genetically modified corn and glyphosate to rats over their lifetime and concluded that the experimental rats had a shorter life expectancy, developed more tumours and had more liver and kidney problems than did a control group. There were horrific pictures of rats with giant tumours that were quickly mapped up by a media not averse to sensationalism.

The response from the scientific community was immediate and harsh. The control group was way too small, there was no disclosure of control rats with tumours, data were improperly interpreted, there was no dose-response relationship and the strain of rat used was genetically susceptible to tumours. Particularly bothersome was the fact that the research group refused to provide advance copies of its work to reporters unless they signed agreements not to consult other experts. Séralini has now stated that he will not allow scientists from the European Food Safety Association to see his results because they are the ones who approved GMOs in the first place. That, to be kind to the man, is bizarre.

The true crux of the matter is that this study has virtually no relevance to people, because the diet the rats were fed is not even remotely reflective of the human consumption of foods that have components derived from genetically modified crops. The media randomly bandy about the statement that roughly 70 per cent of foods contains genetically modified ingredients. Technically that is true, if you consider, for example, high-fructose corn syrup derived from genetically modified corn to be a genetically modified ingredient. The fact is that there is no vestige of genetic modification in this product. It is indistinguishable from any other high-fructose corn syrup.

Although genetically modified sweet corn is grown in a few places, by far the majority of genetically modified corn goes into animal feed. Our consumption of genetically modified ingredients is limited to some food additives that are derived from genetically modified corn, soy or canola. This has little relation to feeding genetically modified corn to rats as the major component of their diet. Furthermore, millions and millions of cattle and poultry have been raised on genetically modified corn over many generations without any health effects being noted in them or their consumers.

What we need in the GMO controversy is reasoned argument, not scandalous headlines. "Study: GMOs may shorten your life," shrieked one report on Séralini's paper. The study shows nothing like that. What it does show is the readiness of some GMO opponents to jump on a questionable study to promote their fearmongering agenda.

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Sept 29, 2012