Inguran, LLC

A Multi-National Technology and Genetics Company Seeking to Improve the Production Potential of the World's Livestock Industry

Key Components

XY, INC-Developing Improved Semen Sorting Technologies

STGenetics-Developing Industry Leading Genetics in Dairy and Beef Cattle

FAST Genetics-Leading provider of maternal lines in commercial Swine Production in North America

Genetic Visions, LLC-Genomics Laboratory

Cytonome, LLC Fluidics

Enlight-Digitial Farming

XY, Inc

Commercial Labs in the in the U.S., India, France, Germany, Italy, New Zealand, Australia, China, the Netherlands

Research Labs and Partner Labs in Middleton and Vienna, Wisconsin; Navasota, Texas and Hamilton, New Zealand

Currently sorting Cattle, Swine, Deer, Sheep, Horse

Studs located in:

1. Fond du Lac, Wisconsin
2. Vienna, Wisconsin
3. Navasota, Texas
4. Tiffin, Ohio
5. Mehoopany, Pennsylvania
6. Chester, United Kingdom
7. Listowe, Canada
8. Bulls housed in Australia, Italy, Germany

Farms located:

1. South Charelston, Ohio 1,200 cows currently in milk with 6,000 heifers
2. Lincoln University Pennsylvania 700 cow dairy for research and embryo production
3. Vienna Farms, Wisconsin- Primary IVF farm 300 donors also research
4. Volm Farms, Kewaskum, Wisconsin-1,200 recipient
5. STG-Navasota, Texas-Commercial IVF and conventional production, Bos Indicus Beef and Dairy Herd
6. FAST Genetics, Saskatoon, Canada-Swine Nucleus Herd
7. Partners with Genosource Group in Iowa, total 3,000 cows in milk

Primary issue with sexed sperm

Fertility

Sexing Technologies

HISTORICAL PERSPECTIVE

1993 First use of sex sorted semen in IVF (Cran et al.)

1996 XY, inc created

1997 Low dose insemination- sex sorted semen (Seidel et al)

1999 Successful freezing of sex sorted semen (Schenk et al)

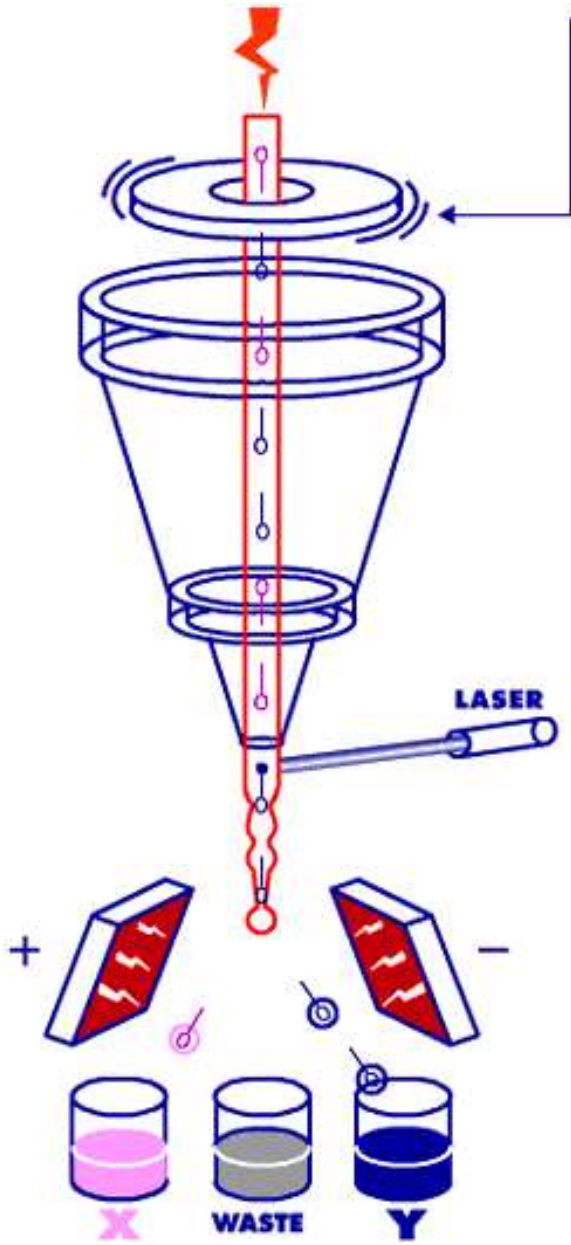
2002 Sexing Technologies

2012 Full automation by CytonomeST

2014 Sexed Ultra ™

2018 SexUtra 4m

Sexing™ TECHNOLOGIES



1. **A piezo electric crystal is undulated approximately 90,000 times/second, which breaks the stream into droplets at a particular point in time. The location of the last-attached droplet in the stream is highly controllable.**

2. An X- or Y-bearing sperm is compared to a preset sort criteria.

3. After a time delay, the insertion rod is charged.

4. A charge is applied at the time the cell reaches the last attached drop.

5. The charged droplets are deflected as they pass between continuously charged plates.

6. Particles not meeting the criteria pass straight down to waste.

Sexing™ TECHNOLOGIES

The common theme

sex sorted semen is lower in fertility compared with unsorted semen.

On average relative fertility of sex sorted semen was around 75 – 80% of that of unsorted semen.

Schenk et 2009; Seidel et al 2009, DeJarnette et al 2010, Seidel, 2012, 2013.

Sexed semen CR is 75 to 80% of that of conventional semen

Treatment	Conception rate %	Proportion compared to conventional
2.1 mill Sex Sorted	45%	74%
3.5 mill Sex sorted	47%	78%
15 mill conventional	62%	

DeJarnette et al 2010

Sexing Technologies

Increasing sperm numbers did not compensate for this sub fertility

Sex sorted		Conventional		
Sperm concentration	Conception rate	Sperm concentration	Conception rate	Relative fertility
2.1 x 10^6	38%	2.1 x 10^6	55%	70%
10 x 10^6	44%	10 x 10^6	60%	73%

DeJarnette et al 2011

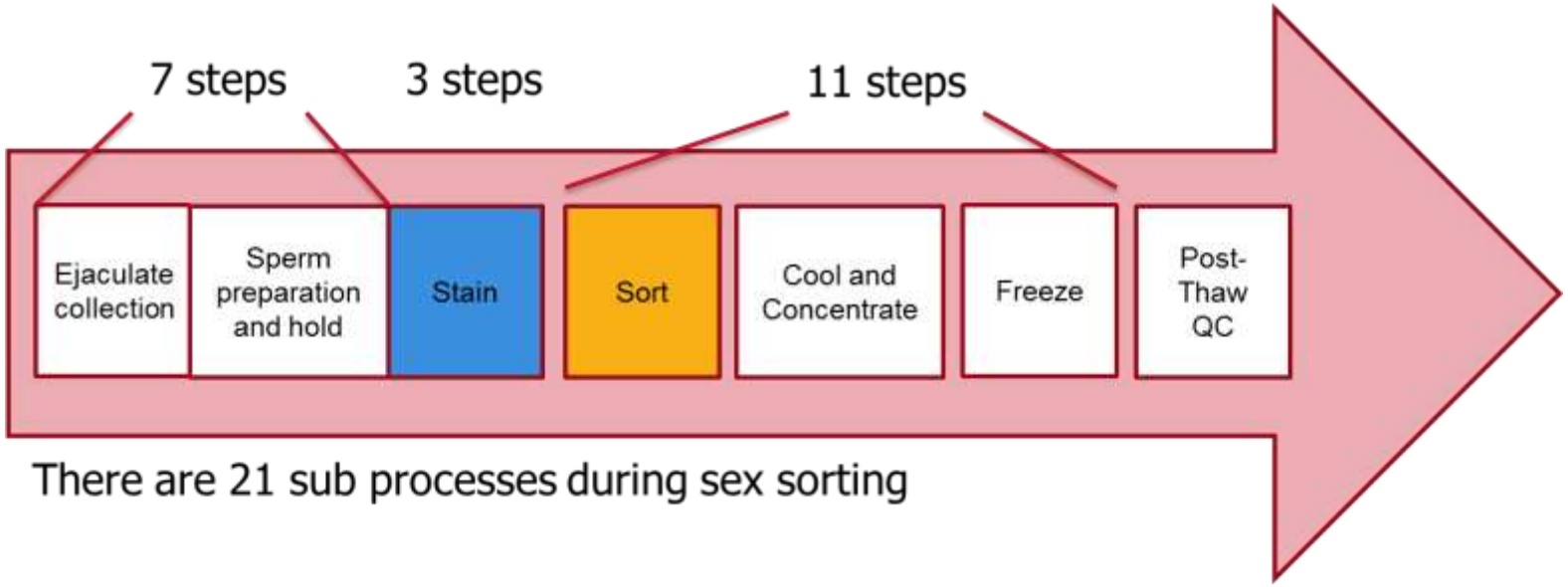
Similar observations in other studies as well Seidel and Schenk, 2008; DeJarnette et al, 2010, Lucena et al 2014

The educated conclusion:

- Flow cytometry alters functional capacity
- Possible fertilization failure??
- Early embryonic death??
- ***Increasing sperm numbers will not alter this probability of fertilization***

Sexing™ TECHNOLOGIES

The cause of diminished functional capacity of sex-sorted sperm is multifactorial



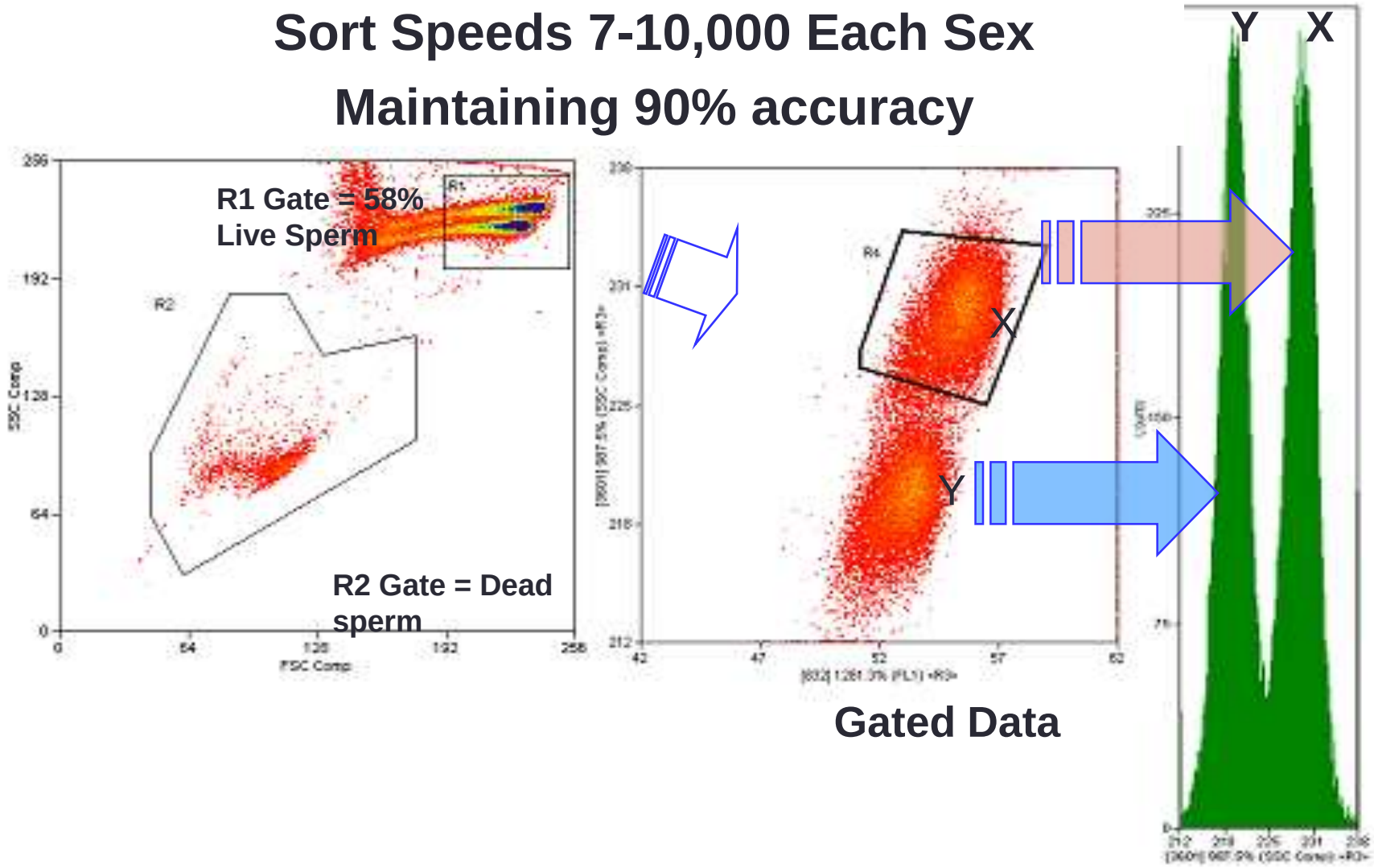
- High dilution (up to 5000×)
- Nuclear staining and incubation
- Mechanical forces (pressure)
- Exposure to UV laser & electric charge
- Projection into collection medium (80-90km/h)
- Post-sorting centrifugation
- Post-sorting freezing/thawing

Sexing TECHNOLOGIES

Sorting profile

Sort Speeds 7-10,000 Each Sex

Maintaining 90% accuracy



Gated Data

The challenge

- Improve sorting techniques – new hardware and software.
- Improve the biochemical processes involved in the sex sorting process
- **Identify the primary lesion for reduced fertility.**

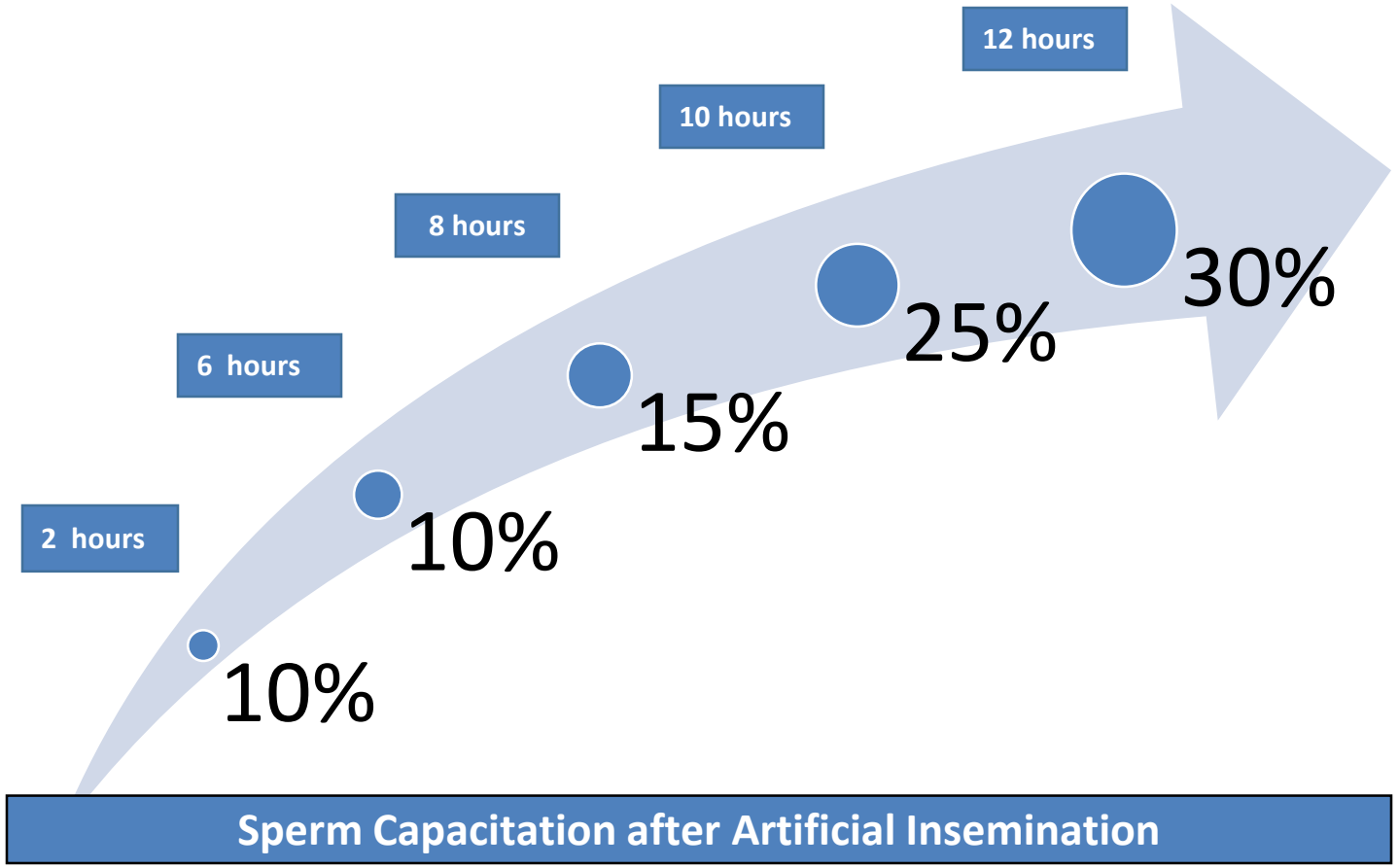
Sexing™ TECHNOLOGIES

- **Physiological heterogeneity**

  - Discrete packets of sperm are physiologically ready for fertilization at different times post insemination – Rodriguez-Martinez, 2006, 2007)

Sexing™ TECHNOLOGIES

Capacitation an essential process where packets of sperm get ready for fertilization at different times



Recent progress

- Semen Biochemistry
- Machine improvements

Sexing TECHNOLOGIES

Trials with SexedULTRA™

	XY Method		SexedULTRA™ method	
	Inseminations	Pregnancy rate (%)	Inseminations	Preganacy rate (%)
Jersey	803	50.7	603	57.2
Holstein	363	39.7	354	50.6
Overall	1166	47.3	957	54.7**

**Significant differences in overall pregnancy rate
XY compared with SexedUltra™ $P < 0.01$

Sex sorting technology – progress through the years

1990-1995	1995-2002	2002-2012
Sort speeds 200 to 400 cells per second, 83% purity 70% fertility of conventional	Sort speeds 1000 cells per second, 85% purity, 80% fertility of conventional	Sort speeds 5000 cells per second, 85% purity, 80% fertility of conventional
1000 conventional straws = 10 sex	1000 conventional straws = 50 sex	1000 conventional straws = 400 sex

Sexing™ TECHNOLOGIES

Last Five years

- Improvements in sorter technology as well as semen processing methods.

- 2012 – 2014
  7,000- 10,000 cells per second
  >93% purity
  92-98% fertility of conventional semen

1000 conventional straws = 1100 sex

Sexing TECHNOLOGIES

STgenetics™

Genetics Visions, LLC

Purchased January 19, 2016

Will provide ability to implement from birth genetic programs

Provides platform for research into genomics, DNA sequencing

Now running VM2 70k platform

STgenetics™

Cytonome does work in all facets of cell sorting and processing.

The Gigasort is being used in Parkinson's Research

Other projects

Amniocentesis for genomic evaluations-processing 3,000 this year with a goal of 5,000 in 2021

Applications include in countries that have Nutrient Management issues

Cloning with amniocentesis-Advance genetic improvement

Genetic Diversity Research-Underrepresented populations in production

EcoFeed-1,200 cow 6,000 heifer research project in South Charleston, Ohio
Looking into Feed Efficiency and Methane production

Thank you