

# Oyster Triploid-tetraploid Technology

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# What are Triploids and Tetraploids ?

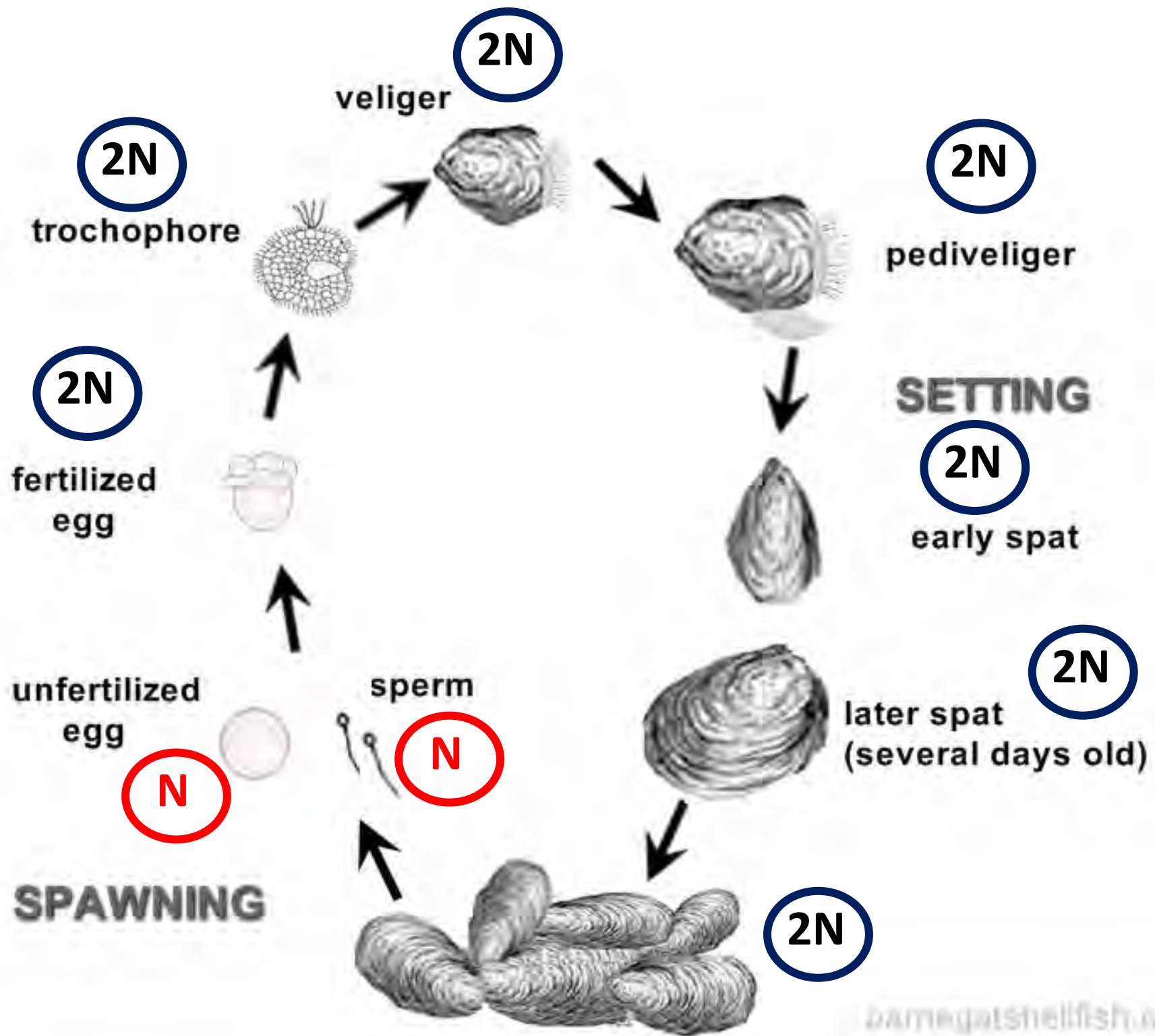
**Triploid (3N):** **Three** set of chromosomes (DNAs)

**Tetraploid (4N):** **Four** set of chromosomes (DNAs)

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**Diploid (2N):** **Two sets** of chromosomes  
(most animals are diploids)

**Haploid (N):** **One set** of chromosomes  
(sperm or eggs)



# Why Triploids in oyster aquaculture?

## Fast growth

In Florida, 8 months to adult size from seed

May also alleviate the fouling on oyster shells

## Better meat-quality

Year-round harvest, especially in hot summer

## No environmental pressure

## Diploids

Showing the full-  
developed gonad



## Triploids

Showing the  
undeveloped  
gonads

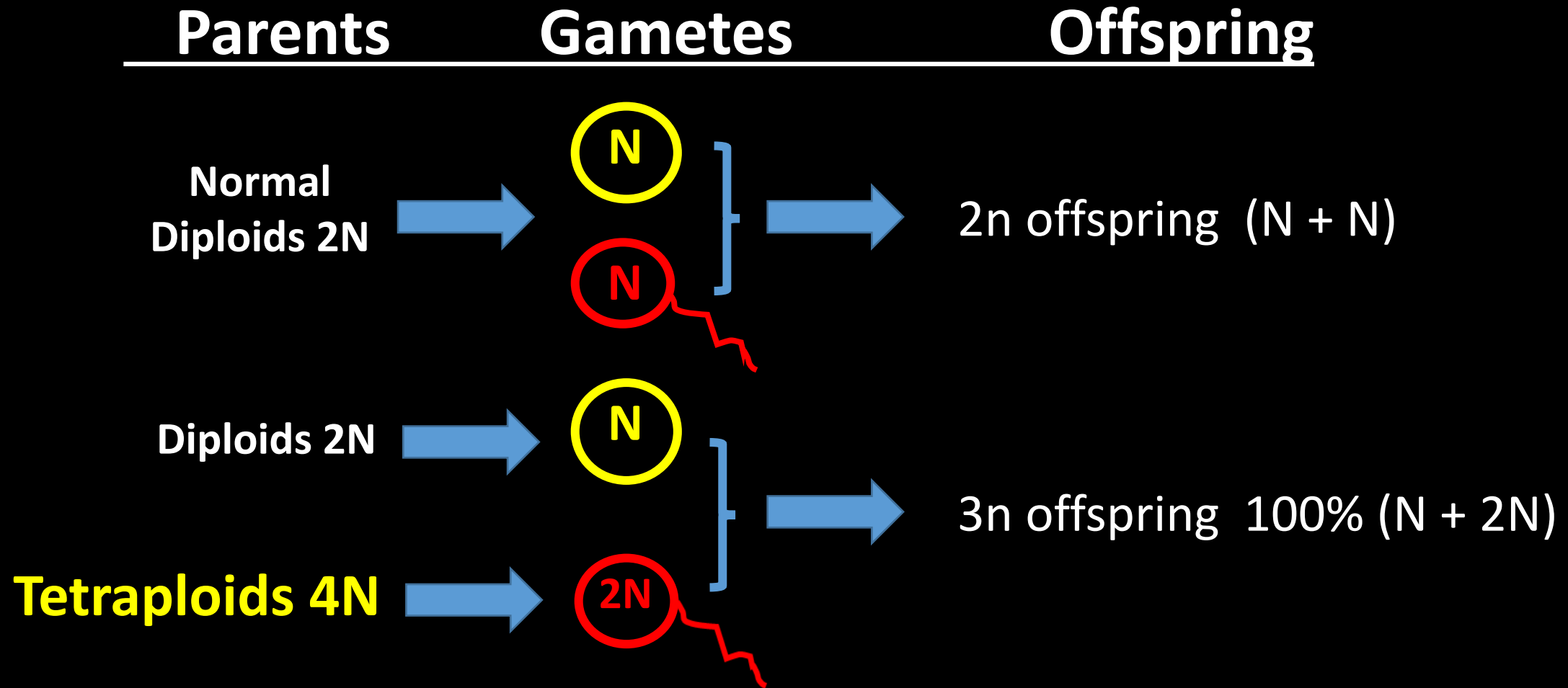


One-year old siblings  
April 19, 2018

**Triploid oysters are NOT GMO organisms**  
same as the Seedless watermelon, banana, or grape



# How triploid oysters are produced?

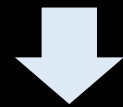


Tetraploid breeding stock is the KEY for this technology

# How to produce tetraploid breeding stock?

## Triploid Production

by  $(2n_{\text{♀}} \times 2n_{\text{♂}})$  plus inhibition of polar body 1 (PB1)  
or polar body 2 (PB2)



## Tetraploid Founder Production

by  $(3n_{\text{♀}} \times 2n_{\text{♂}})$  plus PB 1 inhibition produce  $4n$  Individuals  
Then build up the founders



## Tetraploid Number Expansion

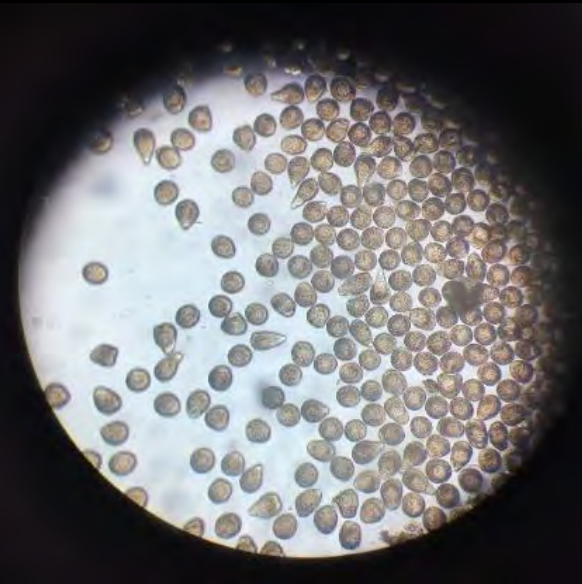
$(3n_{\text{♀}} \times 2n_{\text{♂}})$  plus  
PB 1 inhibition

$(2n_{\text{♀}} \times 4n_{\text{♂}})$  plus  
PB 2 inhibition

$(4n_{\text{♀}} \times 4n_{\text{♂}})$  with  
no PB inhibition



# Step 1. Chemically induced triploid production



# Step 2. 3N females → Tetraploid Induction



Putative 3N oysters



Sex determination



Ploidy determination



Female 3N for 4N production

# Challenges for tetraploid production

## 1. Limited availability of oocytes from 3N females

1) Triploid female occurrence:

1.5% (Yang, unpublished data)

2) Low fecundity:

100 -- 1.6 million per 3N female (Yang, 2018)

## 2. Poor survival of induced putative tetraploid larvae

1) Pacific oysters (Guo and Allen 1994)

0 in two replicates, and 0.0739% in 3<sup>rd</sup> replicate

2) Eastern oysters: Experiment at UF

2018&2019: 100-200 survived to spat but lost in a storm

# Application of triploid-tetraploid technology

Name	Scientific name	Aquaculture (2014)		Triploid-tetraploid Technology
		tones	× 1000 US\$	
<b>Pacific oyster</b>	<i>Crassostrea gigas</i> ( <i>C. angulate</i> )	625,925	1,343,591	50% production in the US Majority in France 2.3 billion seed in China 2018 15% in Australia
<b>Eastern oyster</b>	<i>C. virginica</i>	98,193	108,660	100% in Chesapeake Bay Majority in the Gulf region
<b>Jinjiang oyster</b>	<i>C. hongkongensis</i> <i>C. ariakensis</i>	4,352,694	2,586,029	No data
<b>Sydney oyster</b>	<i>Saccostrea</i> <i>commercialis</i>	--	--	No data

Thank you!

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