ANDROGENESIS & PLOIDY INDUCTION

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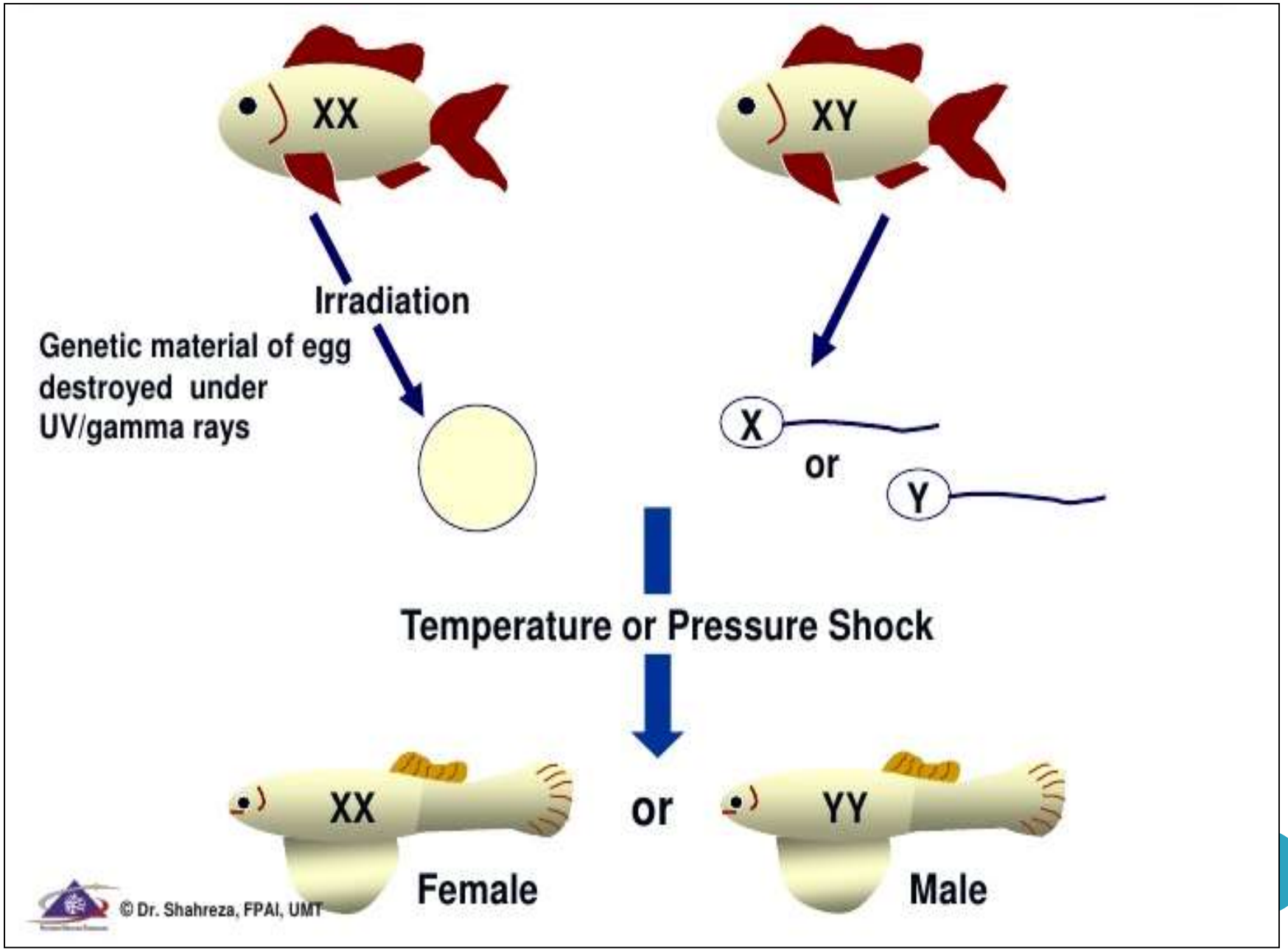
ANDROGENESIS

- Results in all-paternal inheritance.
- Method requires the suppression of the first mitotic cleavage.
- Androgenesis is one of the method in the chromosome manipulation.

ANDROGENESIS

Can be very useful in situation like :

- Males have shorter generation times than female
- Storing of inbred lines in the form of cryopreserved sperm
- Recovering genotypes from cryopreserved sperm


XX
XY
Irradiation
Genetic material of egg destroyed under UV/gamma rays
X
or
Y
Temperature or Pressure Shock
XX
or
YY
Female
Male
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METHODS OF CHROMOSOME MANIPULATION

I. Inactivation of egg:

- Irradiation of the egg with gamma radiation.
- UV rays destroys the genetic material without inactivating the egg.

II.Shock treatment:

Manipulation is done by application of thermal or temperature,pressure,chemical shock

THERMAL SHOCK

- Cold shocks for cold water species (salmonids) - 0°C
- Cold shocks for warm water species (Common carp, Tilapia and Indian major carps), 8-12°C.
- Heat shock for cold water fishes around 26-28°C.
- Heat shock for warm water fishes 39-42°C.

PRESSURE SHOCK

- Simple to administer.
- Pressure range varies between 7000 to 9000 pascals (Psi).
- Less side effect than the thermal shock.

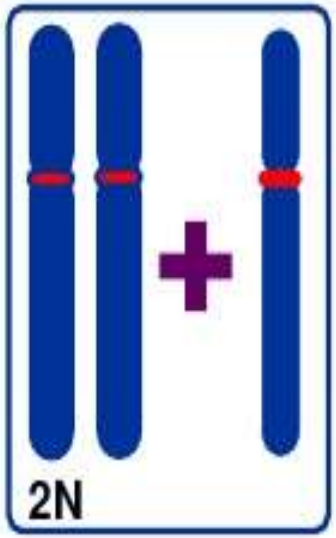
CHEMICAL SHOCK

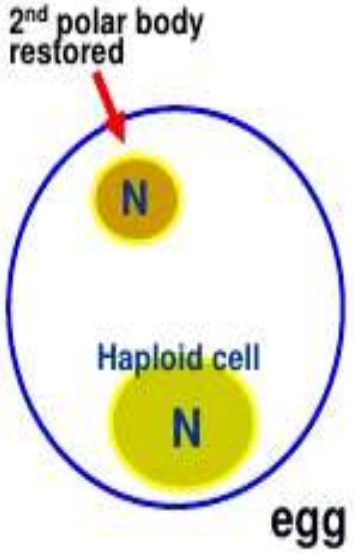
- Colchicine and cytochalasin-b disrupt cell division and induce ploidy induction.

- Anaesthetics such as Nitrous Oxide and Freon 22 induce triploidy.
- But the results are inconsistent and unsatisfactory.

POLYPLOIDY

- Production of individuals with greater than the normal number of chromosomes.
- Leads to the addition in the numbers of chromosomes (more than 2 sets)
- Retention of the polar body through disturbance at the mitosis stage during zygote development
  - temperature shock
  - pressure shock
- Production of sterile fish
  - no gonad development





POLYPLOIDY

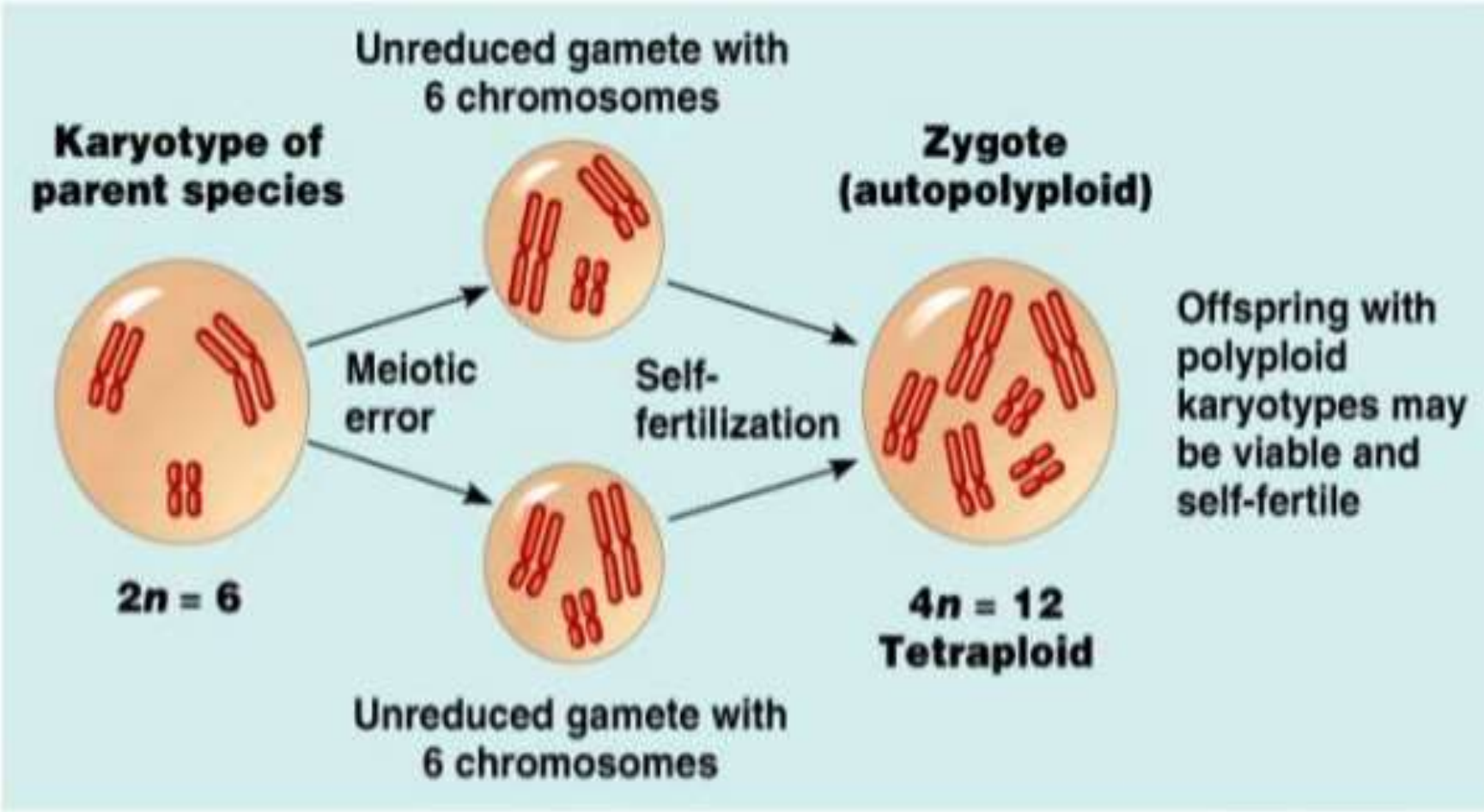
- Benefits of Polyploidy
  - Higher growth rates
  - Better feed conversion
  - Higher survival
  - Higher turnover
  - Resistance to disease

- Suitable for grow out

Example : Oyster, Channel catfish (*Ictalurus punctatus*), *Hemibragus nemurus (baung)*, African catfish (*Clarias gariepinus*)

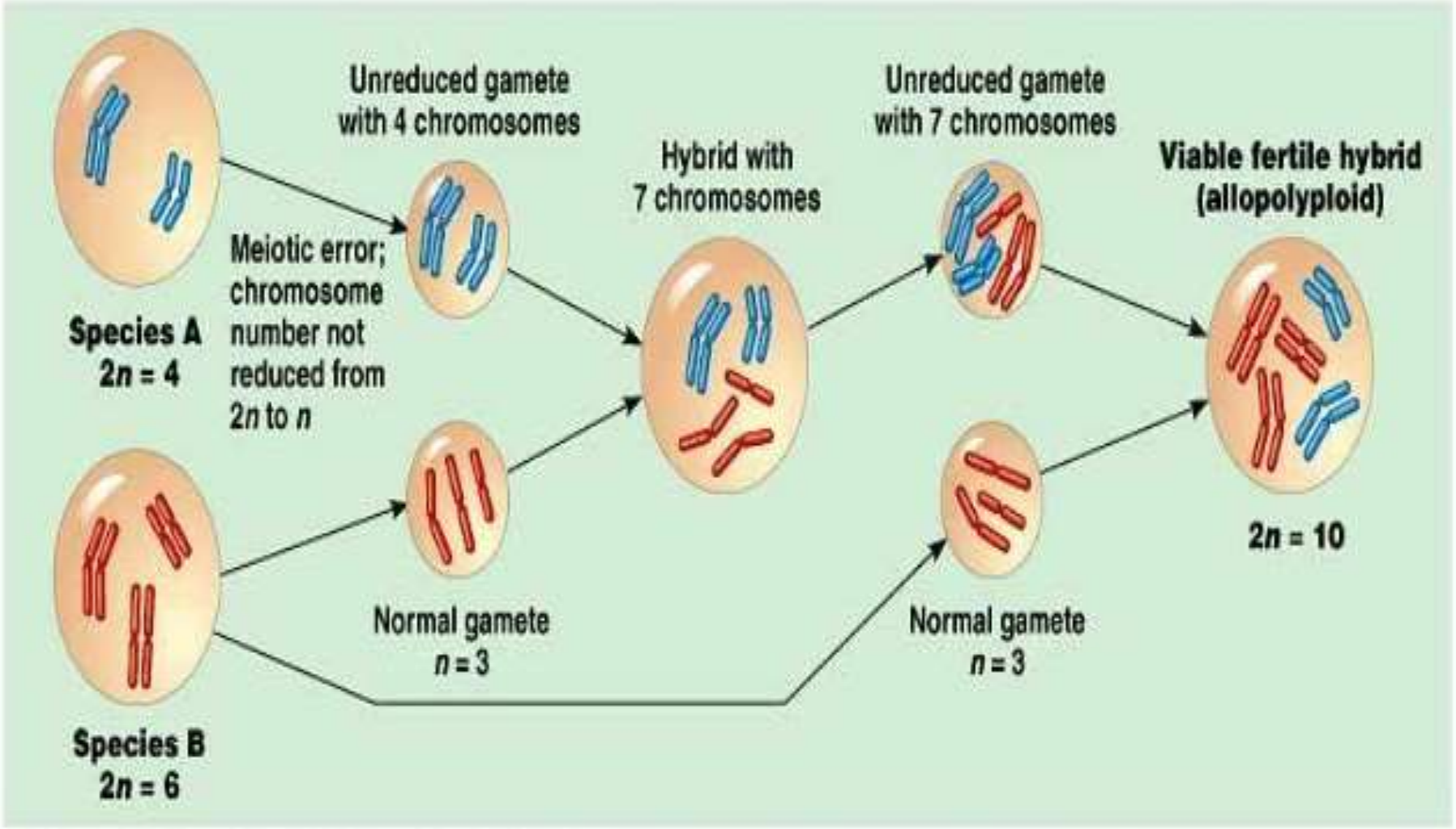
Autopolyploidy

- Containing of multiple copies of the basic set (x) of chromosomes of the same genome .



Allopolyploidy

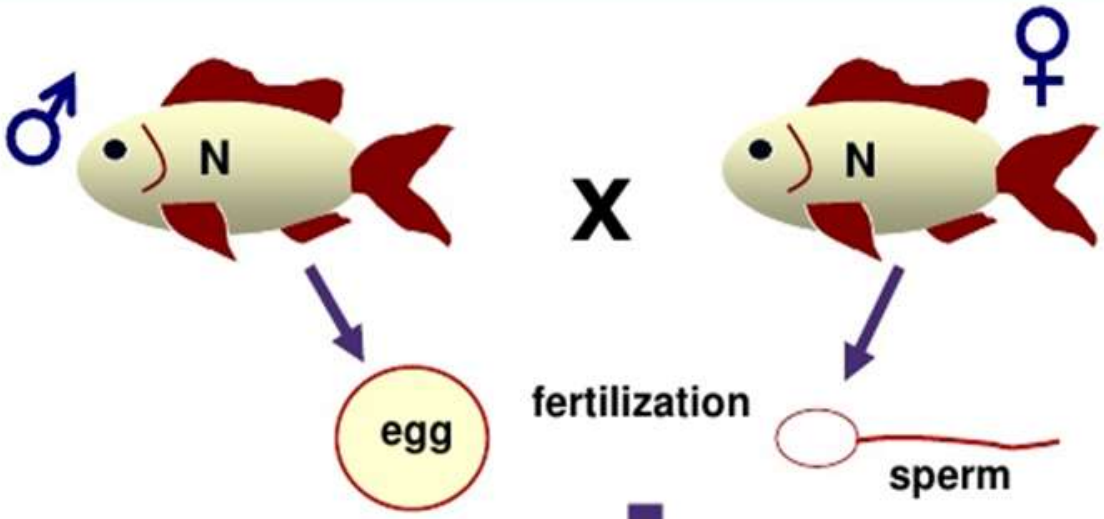
- A combination of genomes from different species .



TRIPLOIDY

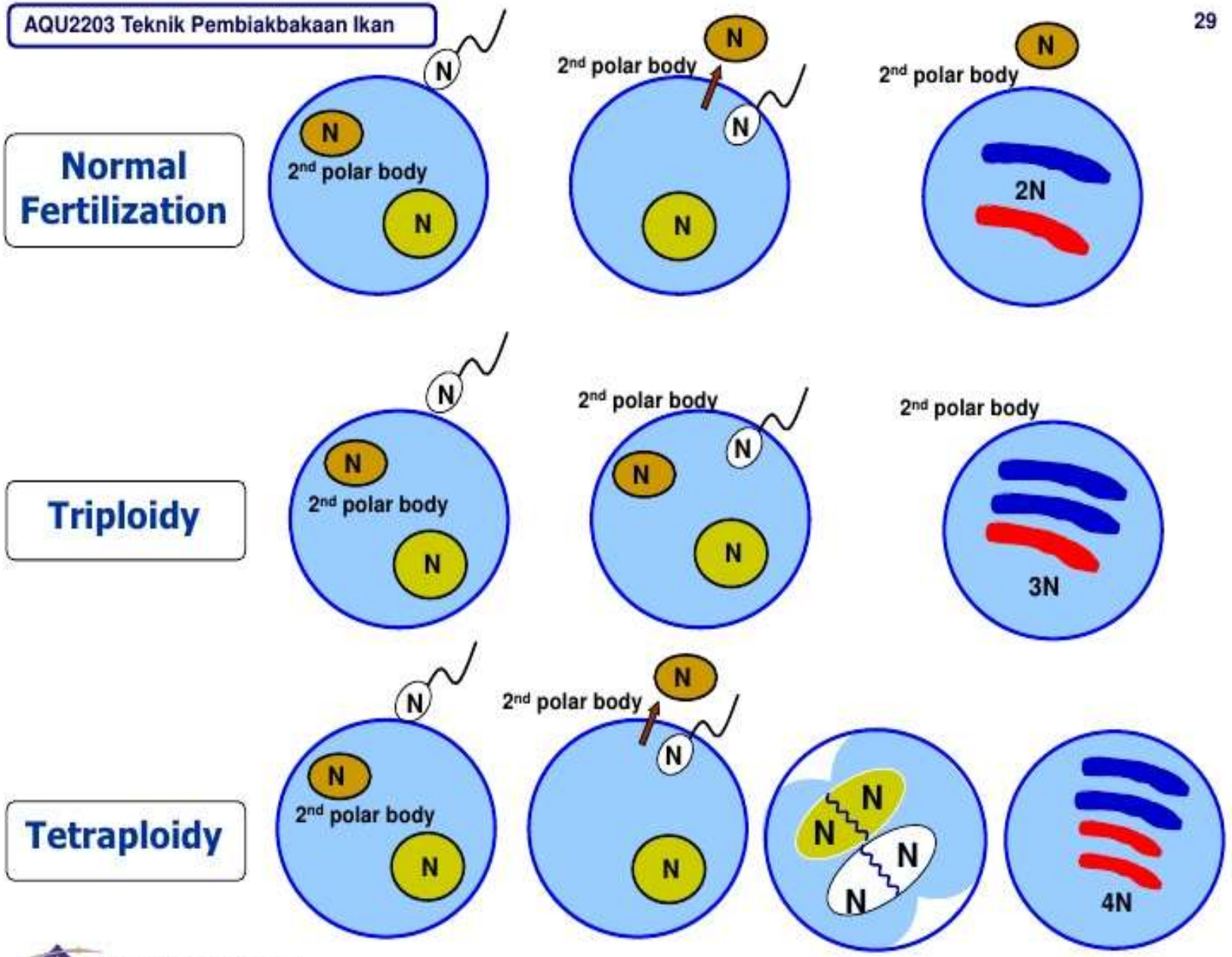
- Triploidy is induced by second polar body retention .
- Triploidy has been induced in common carp & grass carp.
- Triploidy produced by cold & heat shock .
- Crosses between diploid & tetraploidy brood stock can produce triploid offspring.
- This method is used in commercial aquaculture to control reproduction of the alien species , domesticated strains , transgenic fish.

Concept in Production of Triploid Fish



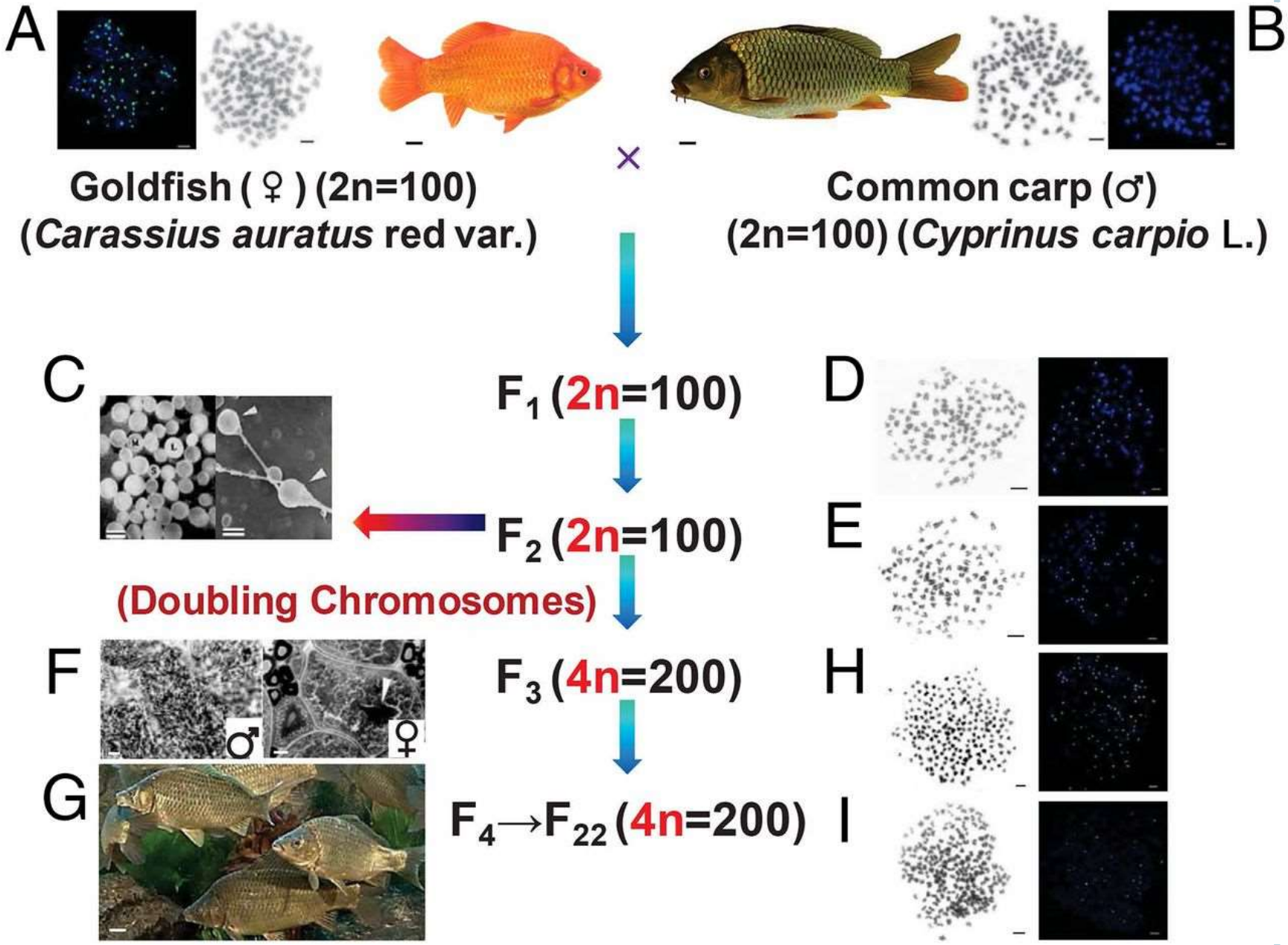
Temperature or Pressure Shock

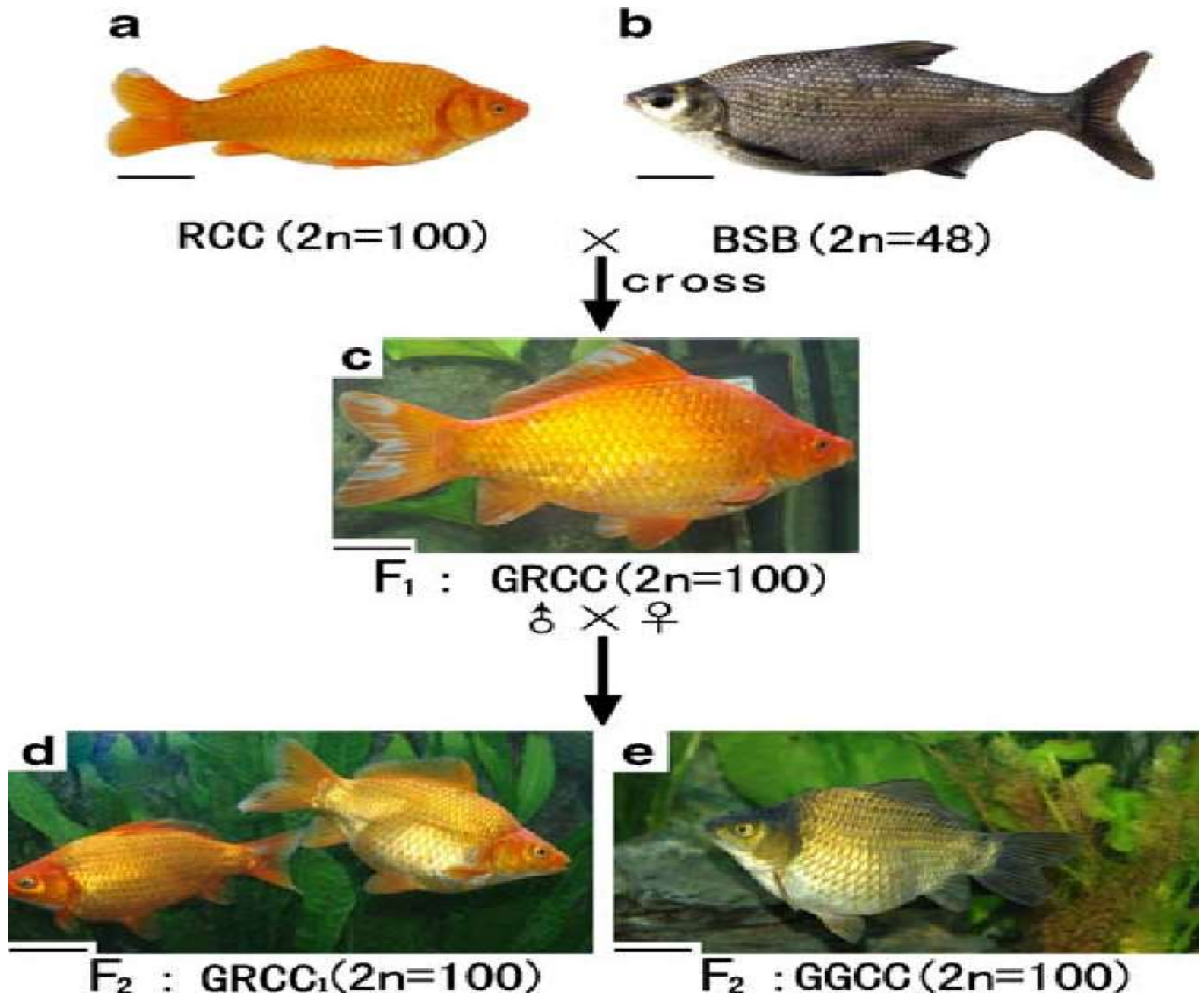
Number of chromosome : 3 set

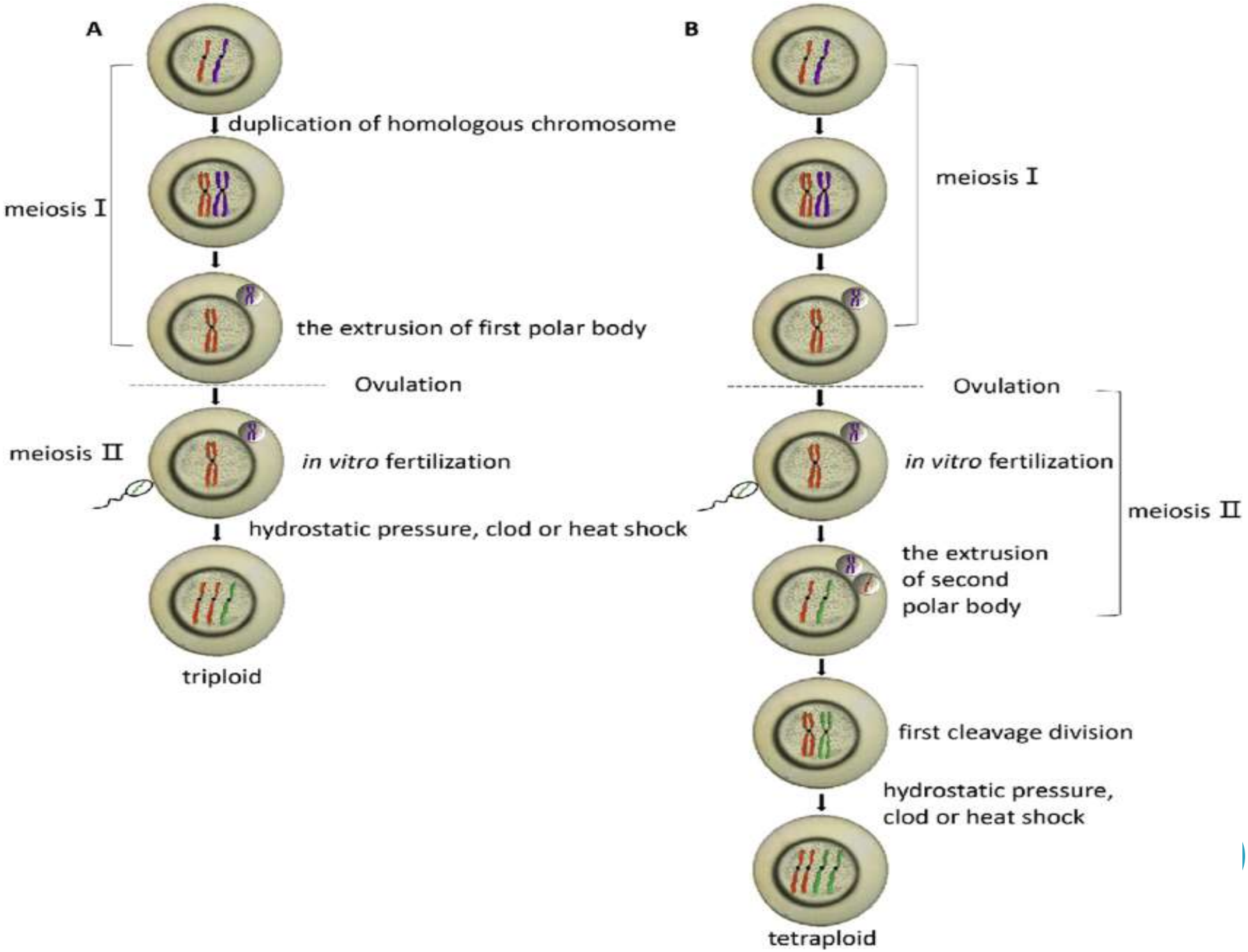


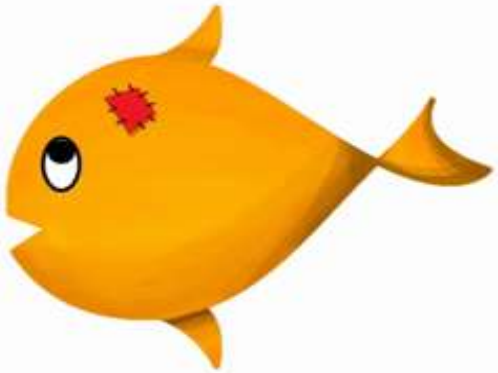
TETRAPLOIDY

- Induction of Tetra ploidy involves applying shock treatment soon after the zygote formation.
- Tetra ploidy is induced by making interference in first mitotic division.
- Tetra ploidy is very difficult method.


A
B
Goldfish (♀) (2n=100)
(*Carassius auratus* red var.)
×
Common carp (♂)
(2n=100) (*Cyprinus carpio* L.)
C
D
F_1 (2n=100)
F_2 (2n=100)
E
(Doubling Chromosomes)
F
♂
♀
F_3 (4n=200)
H
G
$F_4 \rightarrow F_{22}$ (4n=200)
I


a
b
RCC (2n=100)
×
BSB (2n=48)
cross
c
F₁ : GRCC (2n=100)
♂ × ♀
d
e
F₂ : GRCC₁ (2n=100)
F₂ : GGCC (2n=100)


A
duplication of homologous chromosome
meiosis I
the extrusion of first polar body
Ovulation
meiosis II
in vitro fertilization
hydrostatic pressure, clod or heat shock
triploid
B
meiosis I
Ovulation
in vitro fertilization
meiosis II
the extrusion
of second
polar body
first cleavage division
hydrostatic pressure,
clod or heat shock
tetraploid



Thank You!