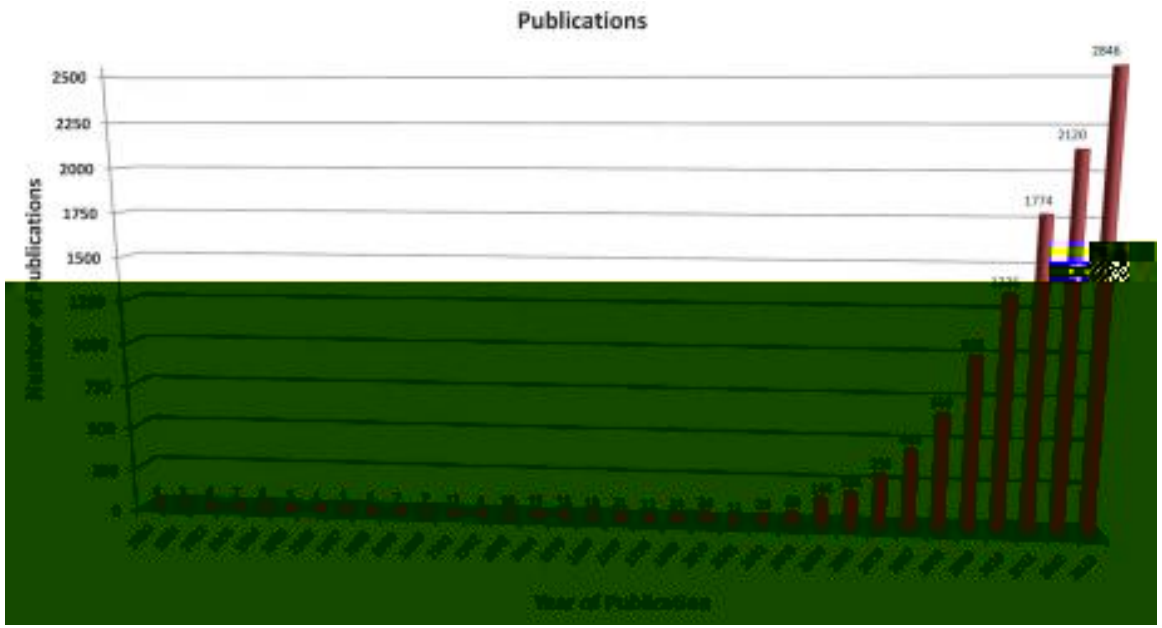
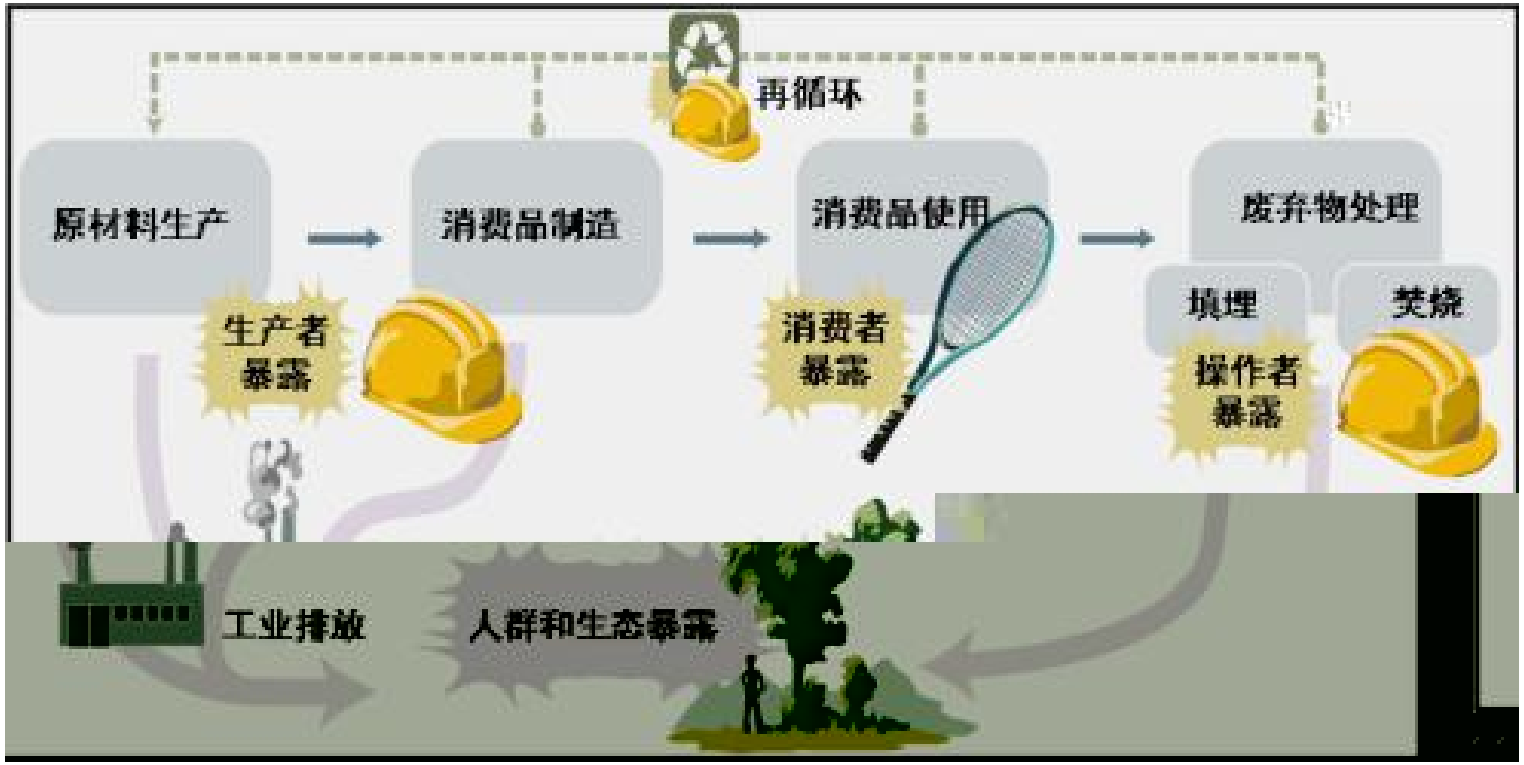
C C

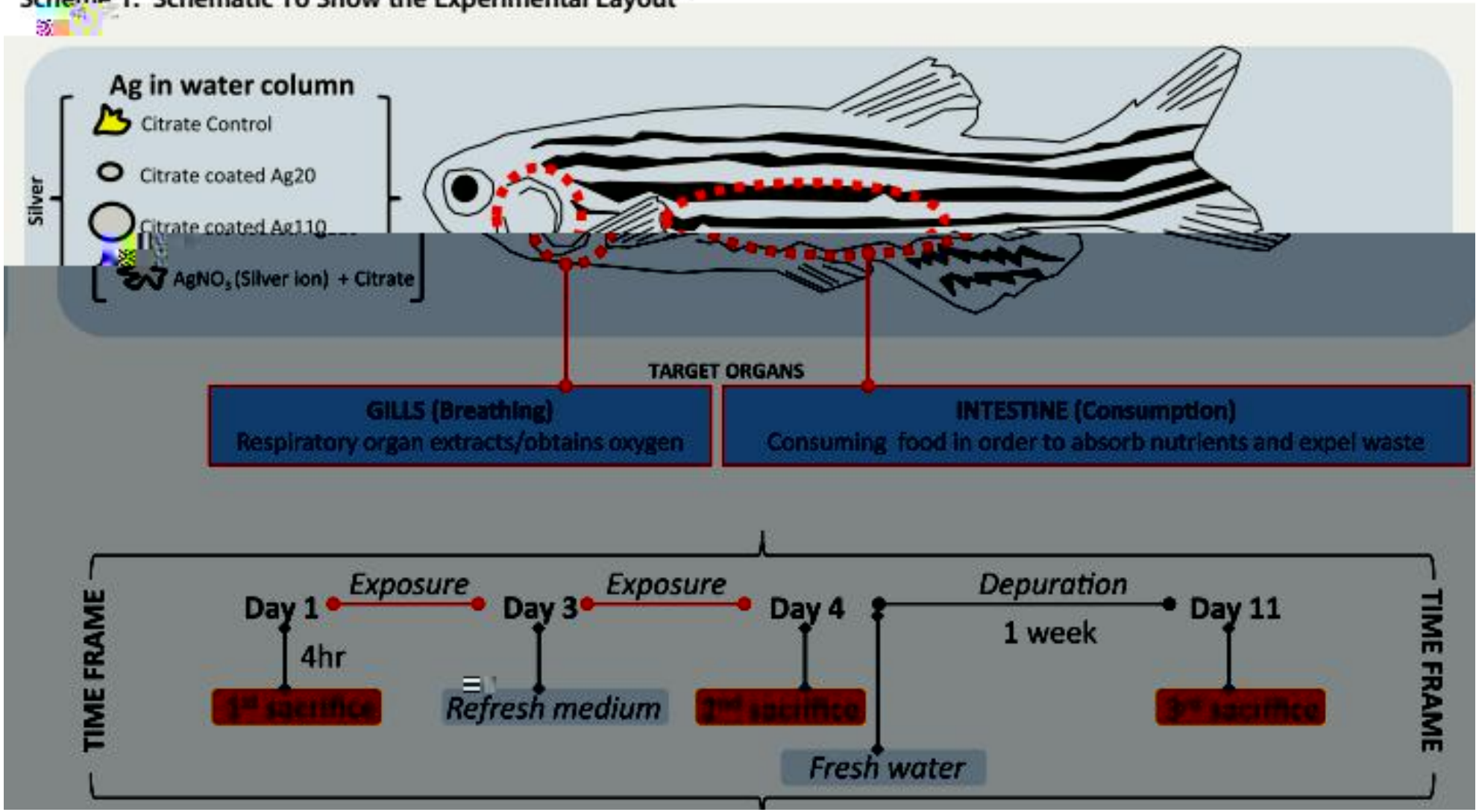
As the nanotechnology industry continues to expand, so does nanoparticle (NP) production, with over 2000 nanoproducts currently in the marketplace.[1] As a result of their attractive antimicrobial properties, silver nanoparticles (AgNPs) are one of the most abundant commercially available nanomaterials, with over 400 nanoproducts containing nano-Ag.[2,3] AgNPs are found in many consumer products (See Table S1) such as cosmetics, plastics, water purifiers, textiles, medicine, and every day applications.[4] Consequently, this amplifies the likelihood of AgNPs reaching water systems, with the possibility of exposing aquatic organisms that reside there. Research using life cycle modeling predicts that the amount of AgNPs reaching surface waters may amount to >60 tons per year,[5] with the possibility of causing hazardous effects in aquatic life forms such as fish and fish embryos.[6]



Category	Product
Appliances	Hair Straighter Iron Bidet
Cosmetics	Beauty Soap Toothpaste
Food & Beverages	Food containers Kitchen utensils Health Supplement
Goods for children	Baby carriage Plush Toys
Health & Fitness	Wound Dressing Sports Socks
Home & Garden	Paint Humidifier


再循环
原材料生产
消费品制造
消费品使用
废弃物处理
生产者
暴露
消费者
暴露
填埋
焚烧
操作者
暴露
工业排放
人群和生态暴露

Scheme 1. Schematic To Show the Experimental Layout[a]



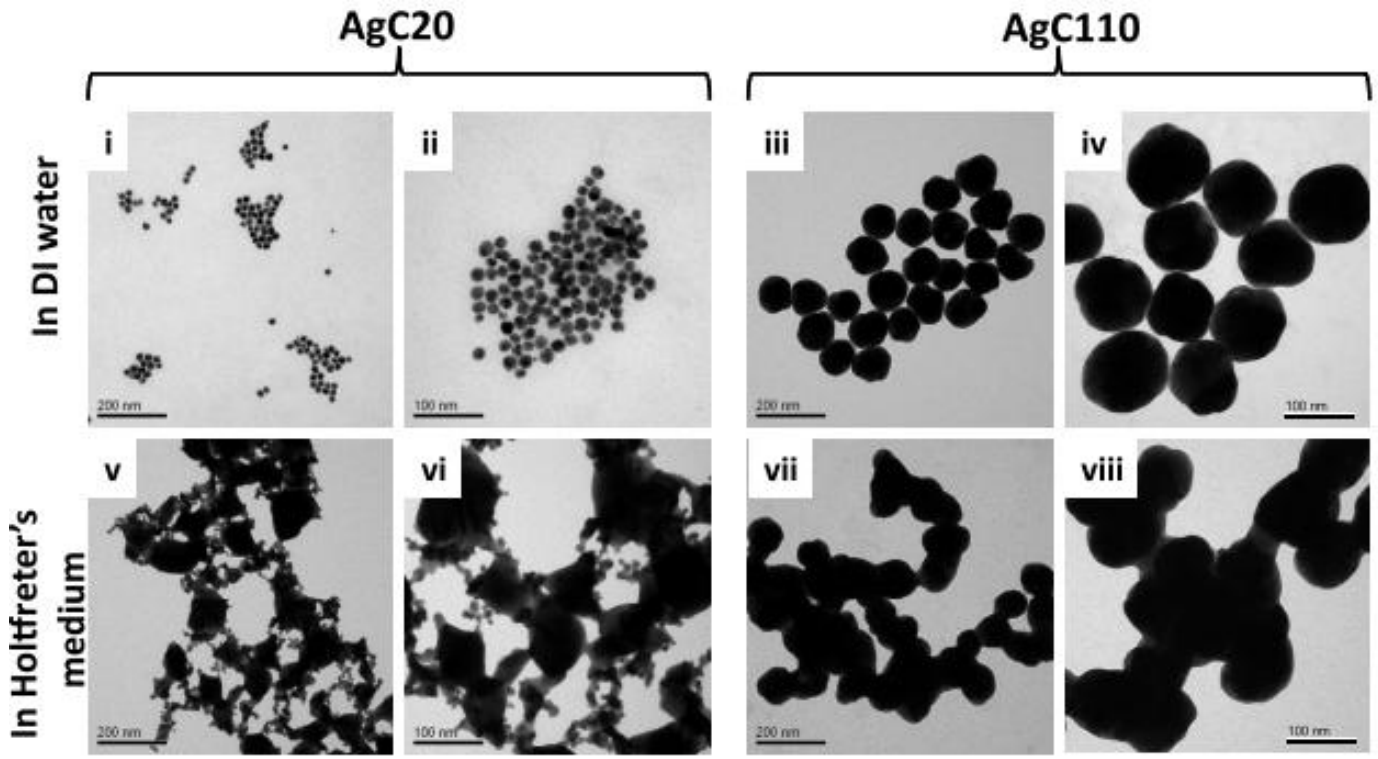
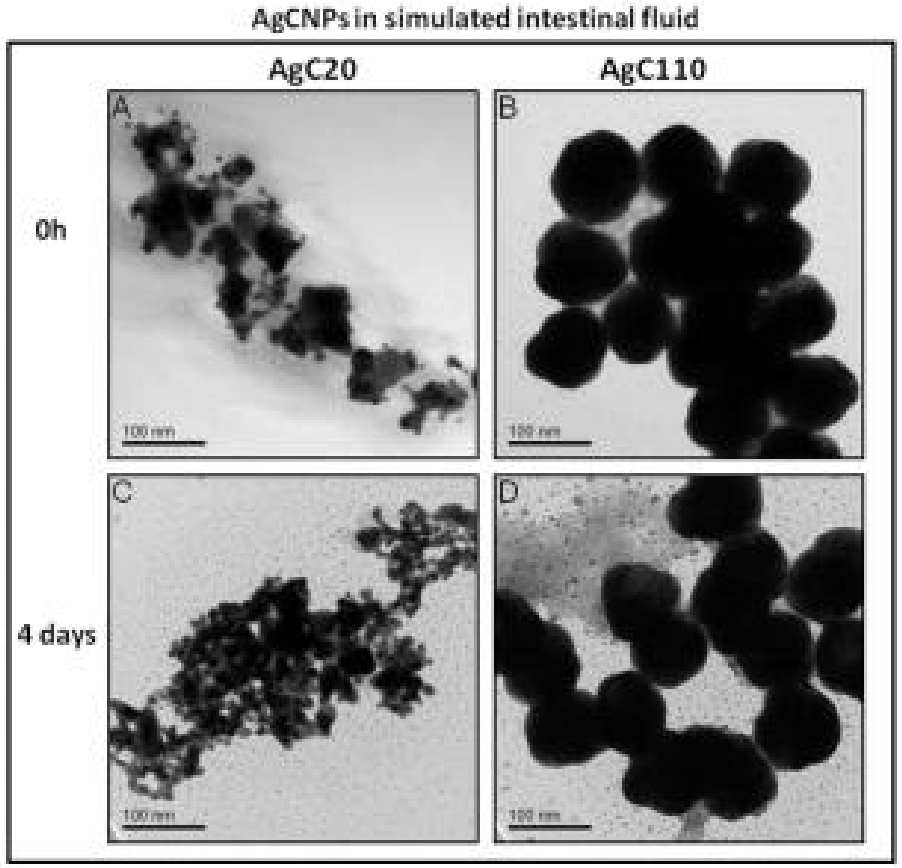

AgC20
AgC110
In DI water
In Holtfreter's medium
i
ii
iii
iv
v
vi
vii
viii
200 nm
100 nm
200 nm
100 nm
200 nm
100 nm
200 nm
100 nm

TABLE 1. NP Hydrodynamic Diameter and ζ-Potential in DI Water and Holtfreter's Medium

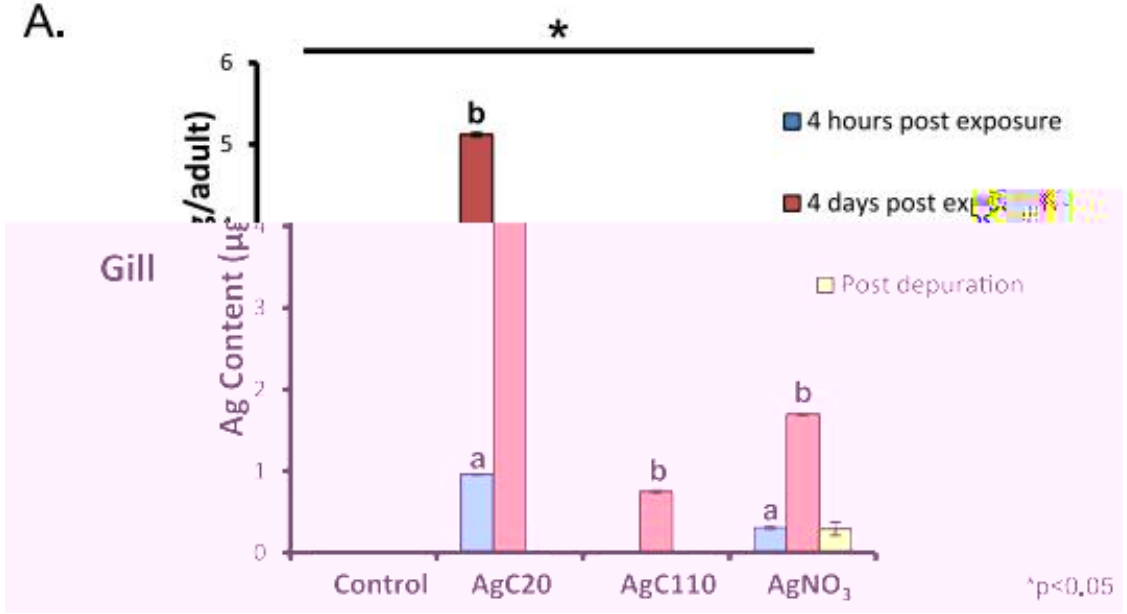
	DI water			HM		
NPs	d_H (nm)	PDI[a]	ζ-potential (mV)	d_H (nm)	PDI[a]	ζ-potential (mV)
AgC20	25.01 ± 0.1	0.053	−9.3 ± 1.5	522.2 ± 37.3	0.323	−16.6 ± 2.1
AgC110	73.1 ± 0.8	0.278	−25.4 ± 4.8	340.5 ± 9.7	0.257	−23.7 ± 2.6

[a] Polydispersity index.

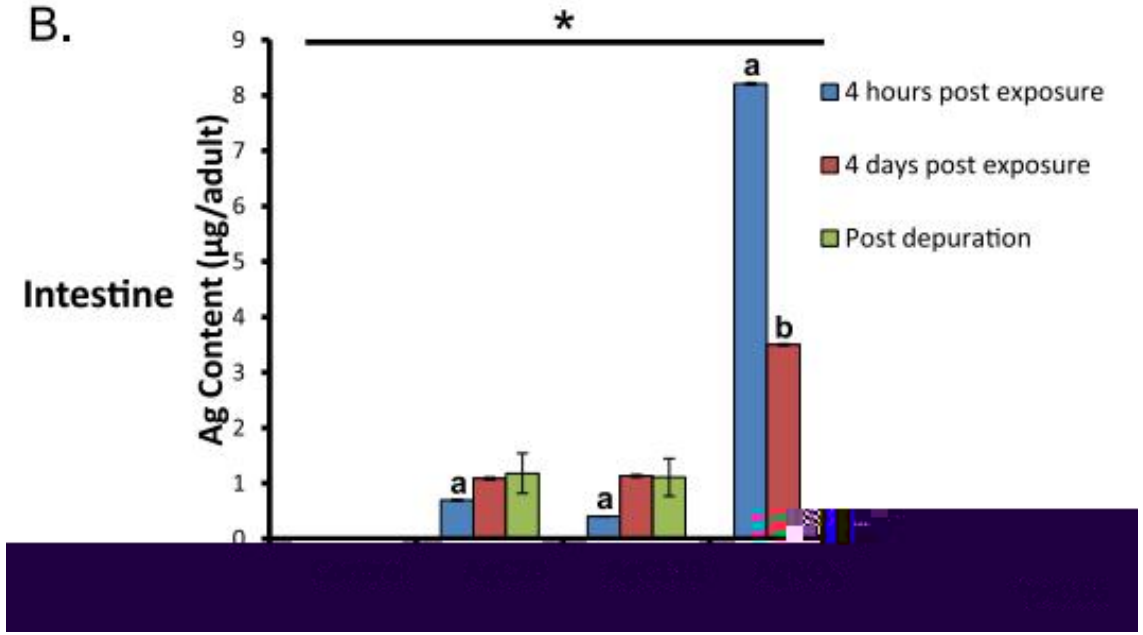


Simulated intestinal fluid	0 hr			4 days		
NPs	d_H (nm)	PdI	ζ-potential (mV)	d_H (nm)	PdI	ζ-potential (mV)
AgC20	1112.5 ±40.5	0.297	-29.65±1.77	759.8±20.4	0.297	-27.72±2.32
	391.1±17.3	0.292	-40.07±4.94	326.7±10.2	0.328	-38.64±2.80

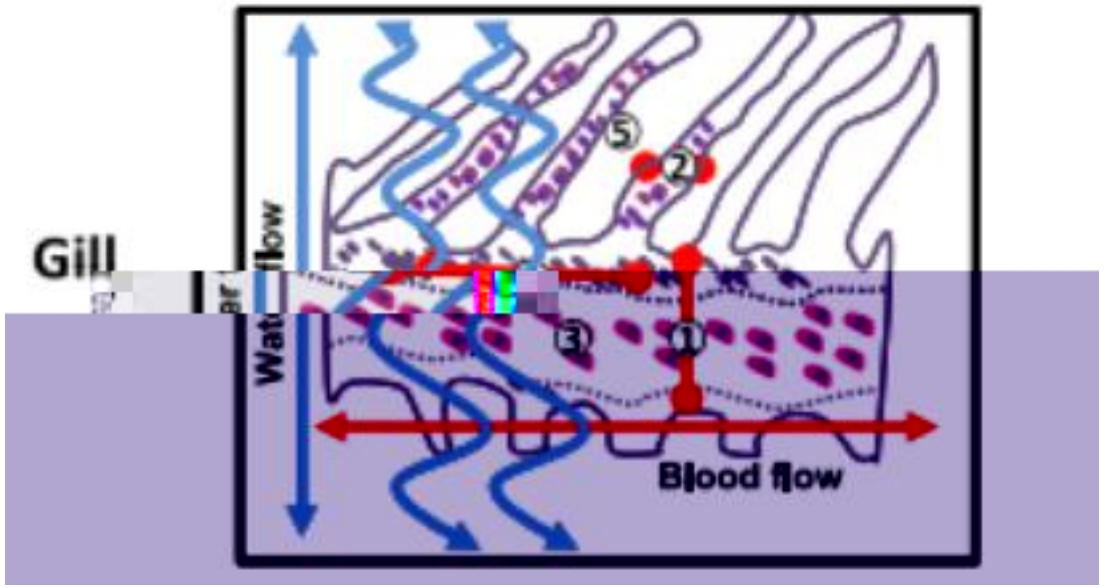
A.


*
Gill
Ag Content (µg/adult)
4 hours post exposure
4 days post exposure
Post depuration
a
b
b
a
b
a
Control
AgC20
AgC110
AgNO3
*p<0.05

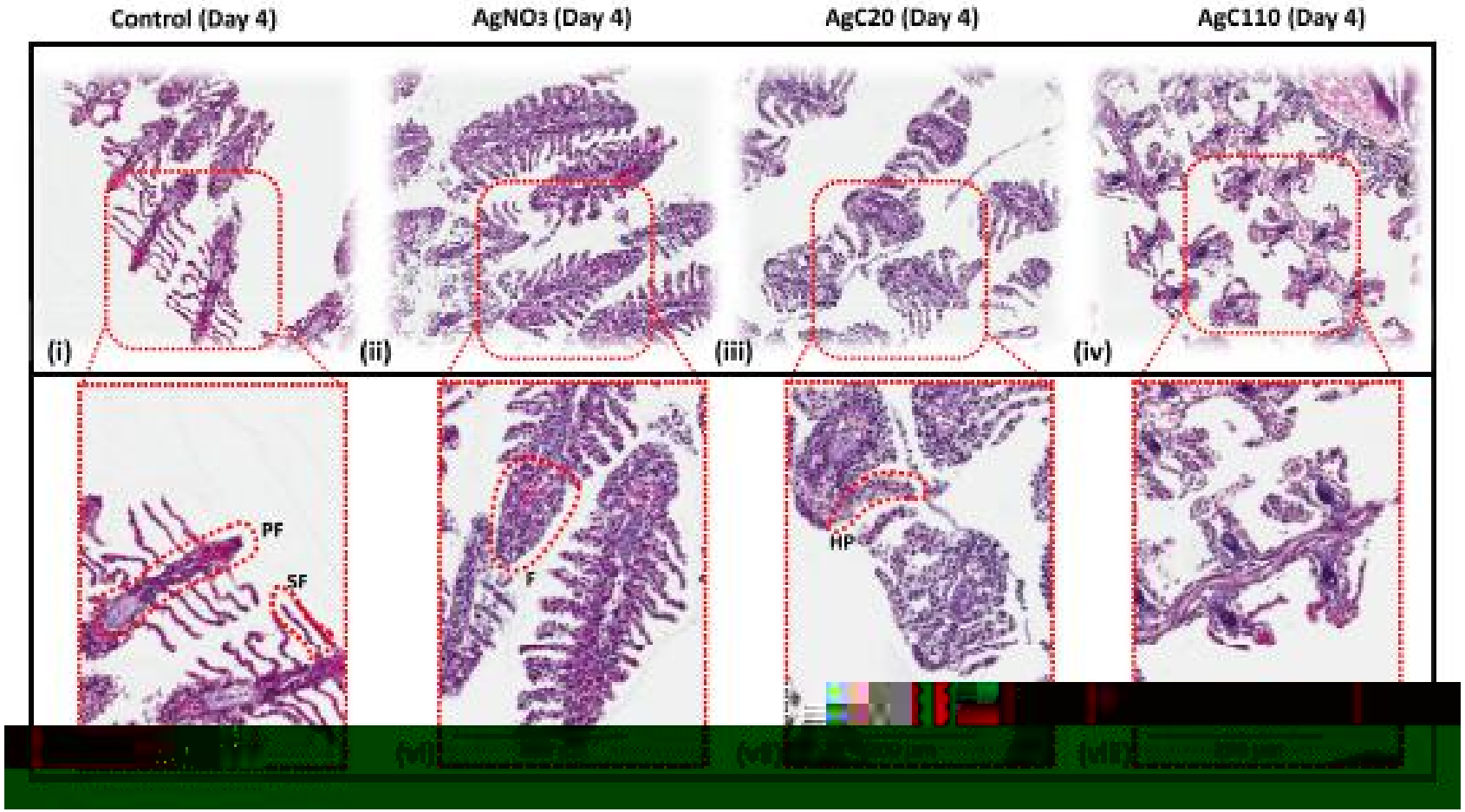
B.


*
Intestine
Ag Content (µg/adult)
4 hours post exposure
4 days post exposure
Post depuration
a
b
a
a
b

A A

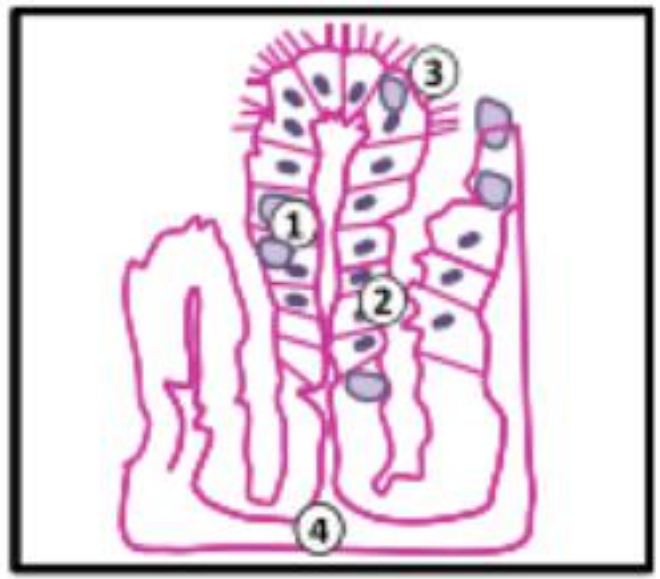


A A

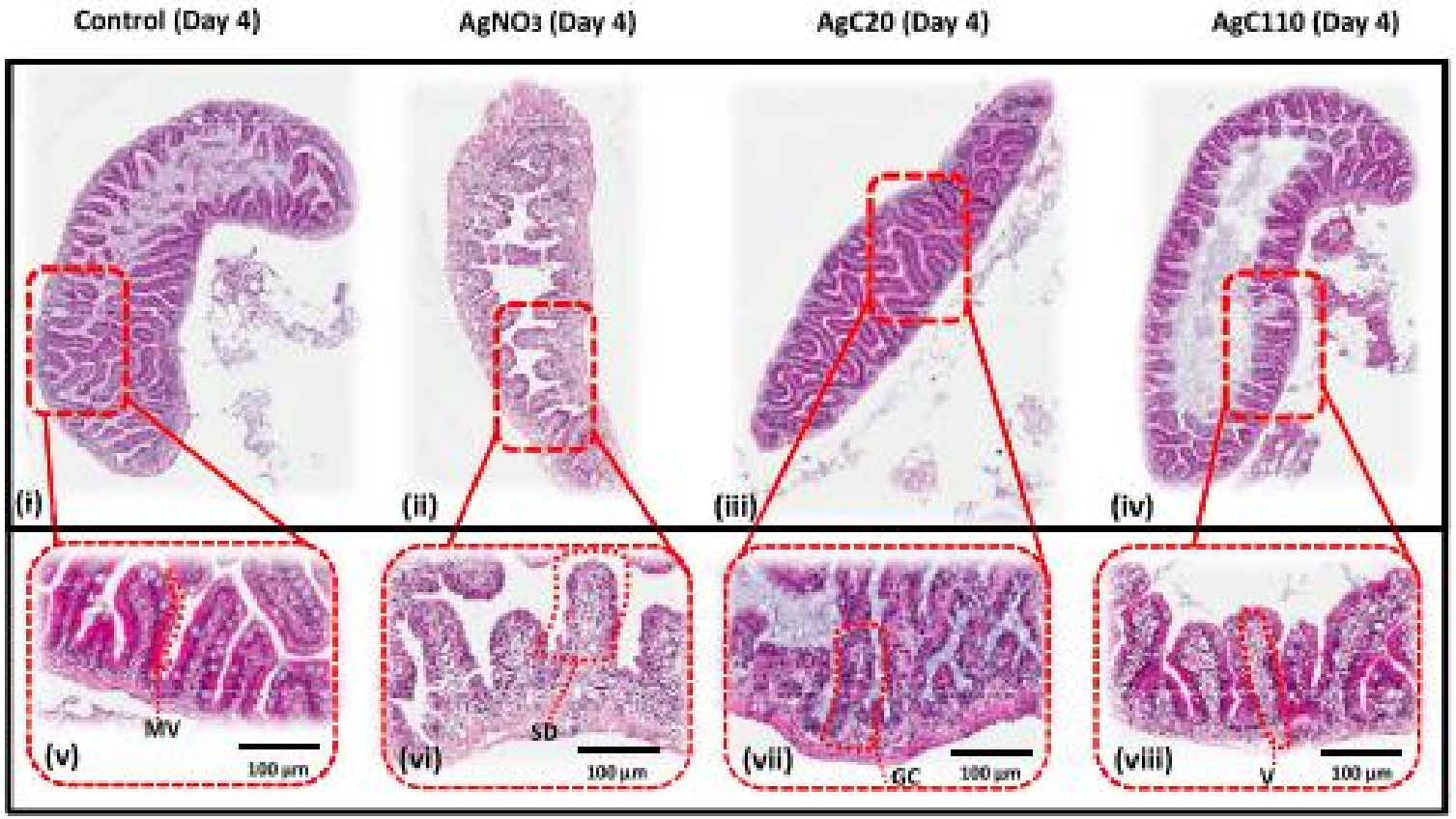

Control (Day 4)
AgNO3 (Day 4)
AgC20 (Day 4)
AgC110 (Day 4)
(i)
(ii)
(iii)
(iv)
PF
SF
F
HP

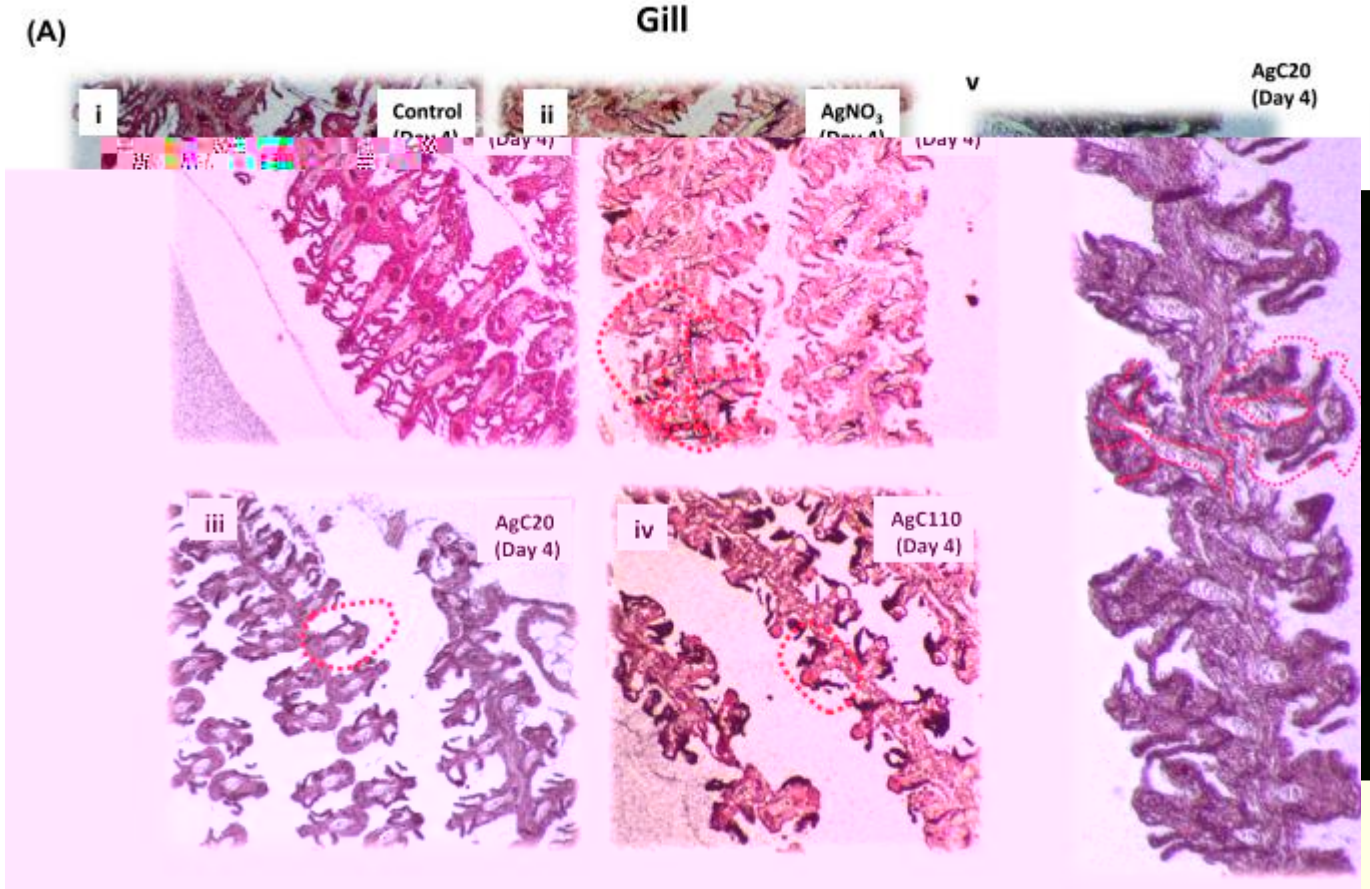
A A

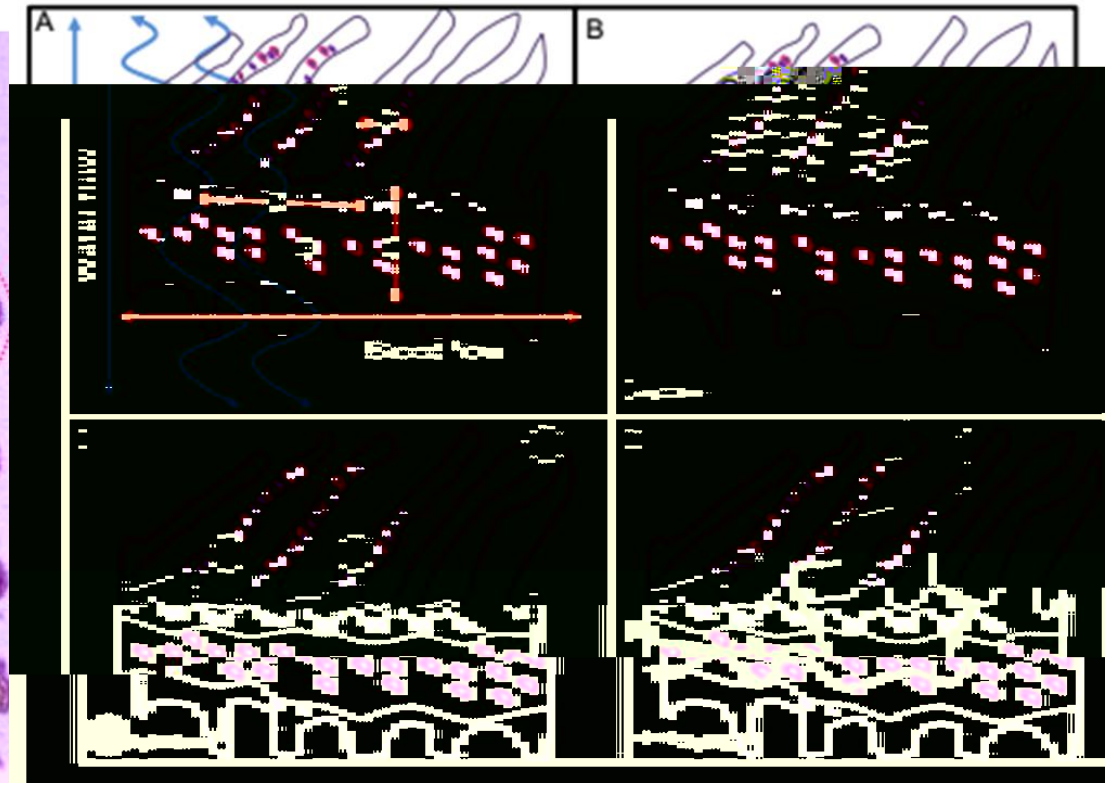
Intestine

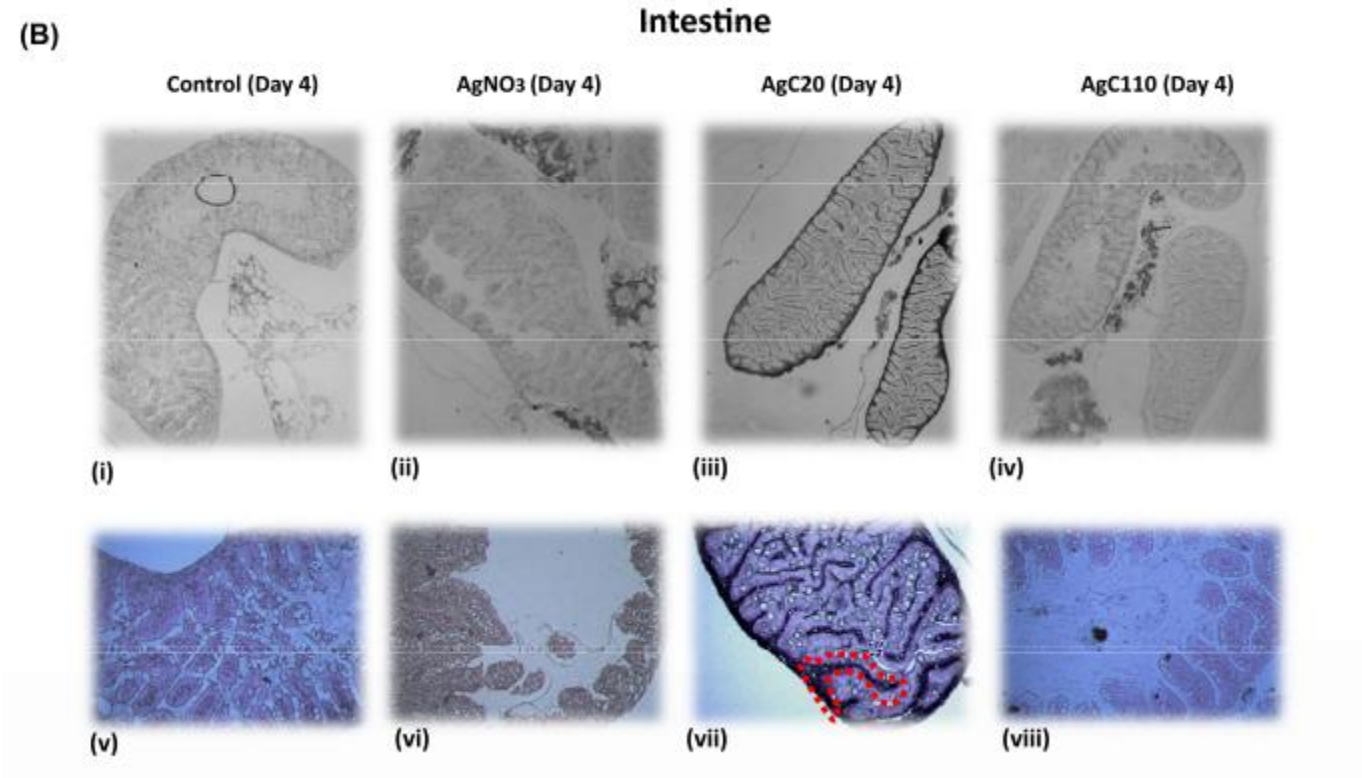


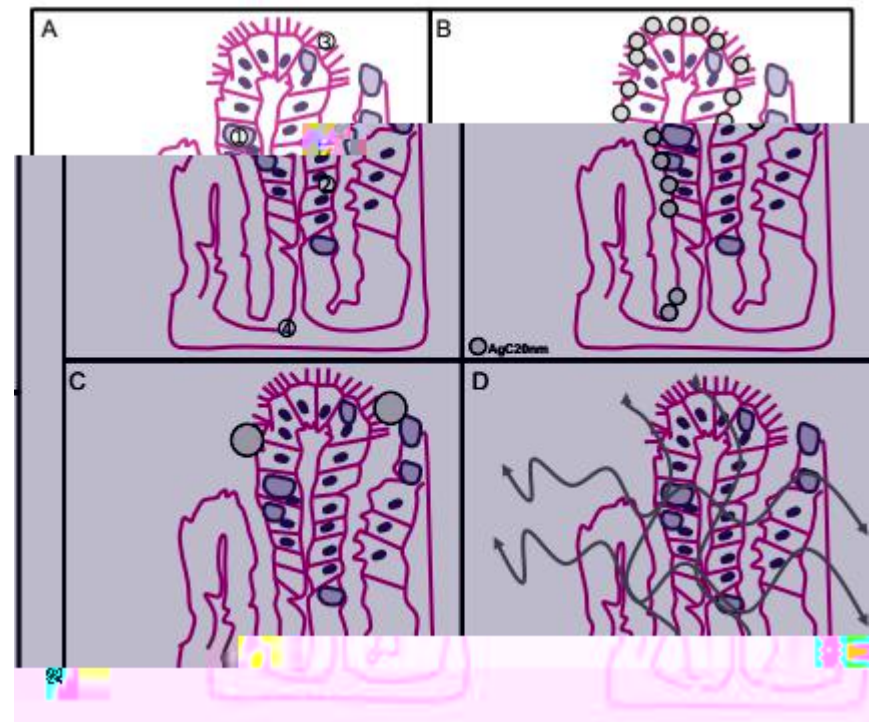
A A

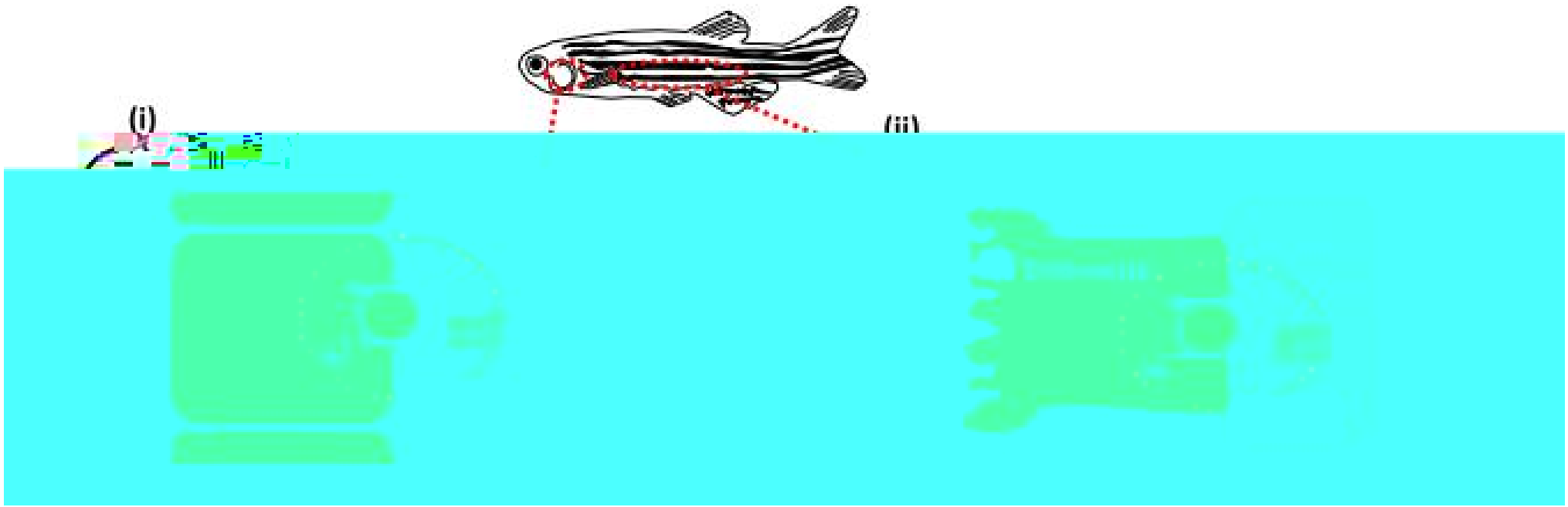

Control (Day 4)
AgNO3 (Day 4)
AgC20 (Day 4)
AgC110 (Day 4)
(i)
(ii)
(iii)
(iv)
(v)
MV
100 µm
(vi)
SD
100 µm
(vii)
GC
100 µm
(viii)
V
100 µm

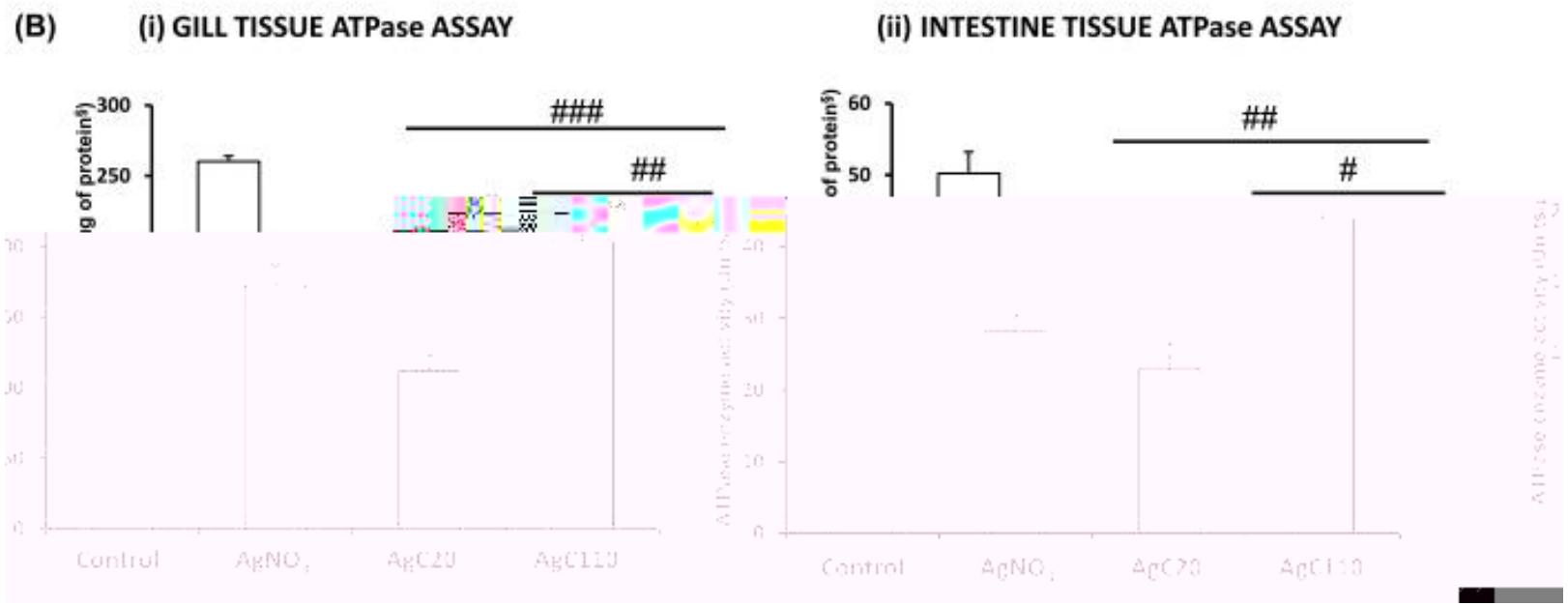

(A)
Gill
i
Control
(Day 4)
ii
$AgNO_3$
(Day 4)
v
AgC20
(Day 4)
iii
AgC20
(Day 4)
iv
AgC110
(Day 4)

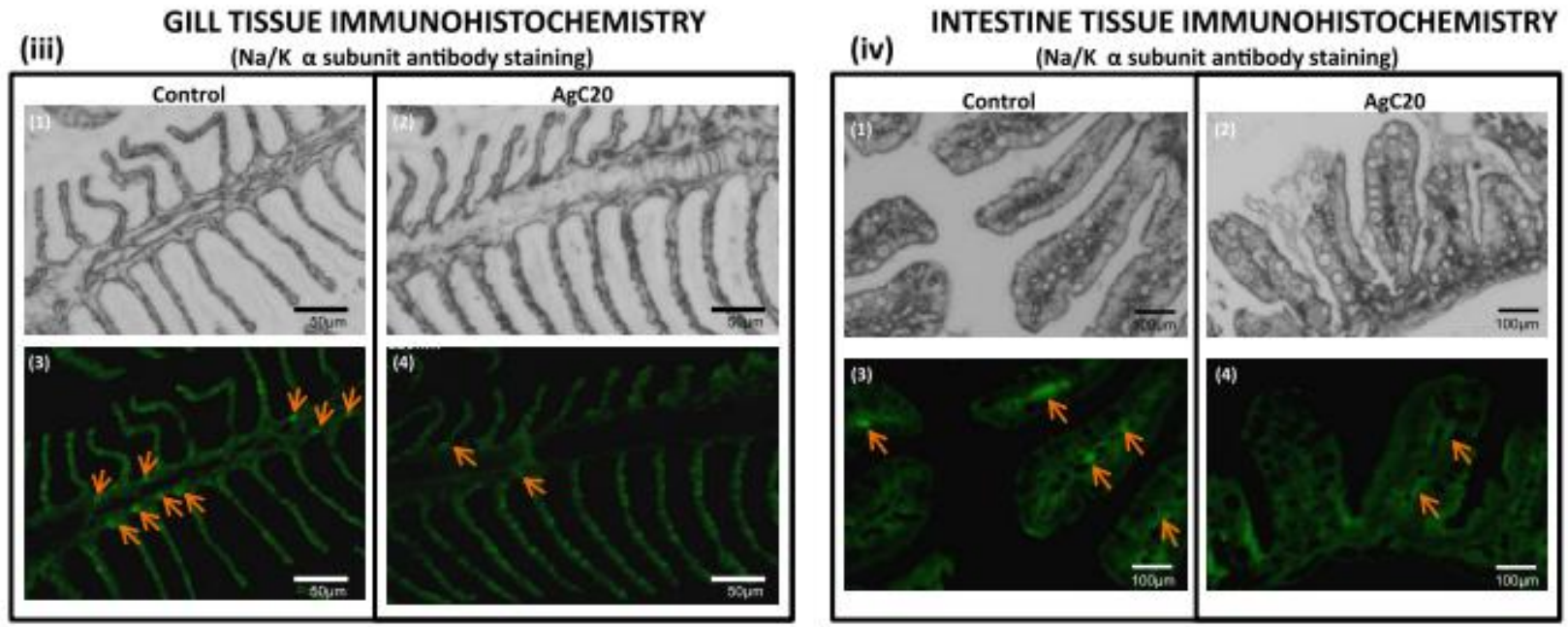

A
B


(B)
Intestine
Control (Day 4)
AgNO3 (Day 4)
AgC20 (Day 4)
AgC110 (Day 4)
(i)
(ii)
(iii)
(iv)
(v)
(vi)
(vii)
(viii)


A
B
C
D
AgC20nm


(i)
(ii)


(B)
(i) GILL TISSUE ATPase ASSAY
(ii) INTESTINE TISSUE ATPase ASSAY
300
250
60
50
###
##
##
#
Control
AgNO3
AgC20
AgC110


(iii)
GILL TISSUE IMMUNOHISTOCHEMISTRY
(Na/K α subunit antibody staining)
Control
AgC20
(1)
(2)
(3)
(4)
50µm
(iv)
INTESTINE TISSUE IMMUNOHISTOCHEMISTRY
(Na/K α subunit antibody staining)
Control
AgC20
(1)
(2)
(3)
(4)
100µm

Thank you