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Diversity and transfer efficiency of IncHI2 plasmids from *Escherichia coli*

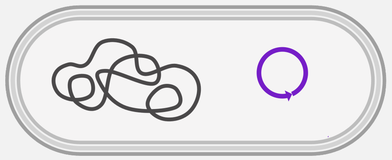
What is a plasmid?

Unlike the bacterial chromosome, plasmids are **not essential to survival**.

Plasmids are classified into incompatibility groups: two plasmids that cannot stably coexist within the same bacterial cell generally belong to the same group.

Chromosome

- ✓ Always present
- ✓ Contains the **gene essentials for function**



Escherichia coli

Plasmids

- ✓ Distinct from the chromosome
- ✓ Circular
- ✓ Replicate independently
- ✓ **Vary in size and genetic content**
- ✓ May carry genes that confer advantages to their bacterial host

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How are they important?

Can **provide benefits** to bacteria

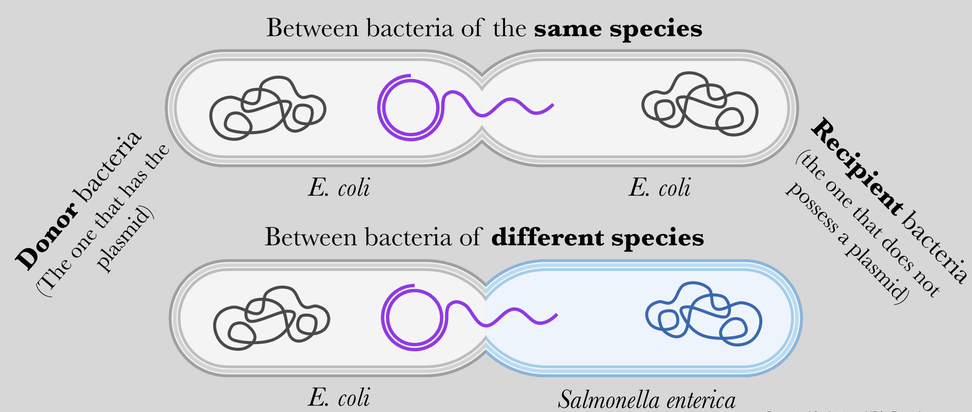
- ✓ **Resistance** to antibiotics and metals
- ✓ Increased virulence
- ✓ Toxin production
- ✓ And many more

Can **be transferred between bacteria**

- ✓ Transfer their genes to another bacteria that does not carry plasmids
- ✓ Confer their advantages to the recipient
  - ✓ Make strains resistant and/or more resistant to more antibiotics
    - ✓ Limit the antibiotics available for treatment

How are plasmids transferred?

They spread through **horizontal gene transfer**, the transfer of genetic material from a donor bacteria to a recipient bacteria. This process is called **bacterial conjugation**.



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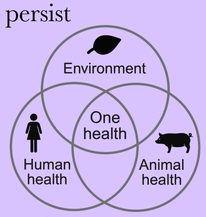
What is the significance of **IncHI2** plasmids?

They are **large plasmids**

- ✓ Can carry a **greater diversity of genes** than smaller plasmids
  - ✓ Can therefore confer **resistance to a wider range of antibiotic classes**
  - ✓ Can also confer resistance to various metals and disinfectants
  - ✓ Can **promote bacterial survival** in environments where the bacteria would otherwise be unable to persist

They have a **broad host range**

- ✓ Frequently found in different bacterial genera
  - ✓ *Escherichia*
  - ✓ *Salmonella*
  - ✓ *Klebsiella*
- ✓ Also found in bacteria of human, animal, and environmental origin



IncHI plasmids are **among the plasmid groups carrying the highest numbers of antibiotic resistance genes**

- ✓ Can transfer these genes to another bacteria in a single transfer

Optimal transfer temperature is between 22°C and 30°C

- ✓ Transfer can occur in manure pits
- ✓ This can increase antibiotic resistance in the animals' environment

What **challenges** do plasmids pose in animal production?

When a bacterial strain acquires a plasmid carrying antibiotic resistance genes, it may **become resistant to previously effective treatments**.

- ✓ This can make **bacteria resistant to multiple antibiotics** and **complicate the treatment** of animal infections.

Can promote **bacterial persistence on pork farms** through genes conferring resistance to metals or disinfectants.

- ✓ Contribute to the **spread of resistance genes between bacteria** in animals and their environment.

My project aims to:

Characterize IncHI2 plasmids found in pathogenic *E. coli* of animal origin

- ✓ Identify and **confirm IncHI2-carrying strains** through sequencing
- ✓ Examine their genetic content using **bioinformatic analyses**
- ✓ **Assess transfer efficiency** within species (between *E. coli* strains) and between species (between *E. coli* and another species)

Identify **genes essential for interspecies transfer** of IncHI2 plasmids

- ✓ Assess the effect of mutations in these genes on transfer efficiency

Examples of resistances carried by IncHI2 plasmids from *E. coli* of porcine origin

Shows the pathotype of each strain of porcine origin and the resistance associated with the antibiotic resistance genes present.

■ = resistant, □ = susceptible

ETEC = Enterotoxigenic *E. coli*

STEC = Shiga toxin-producing *E. coli*

Caracteristics	Strain resistances				
Pathotype	Tetracycline	Penicillins	Amoxicilins / ampicillins	Trimethoprim	Sulfanomides
ETEC	□	□	□	□	■
ETEC	■	■	■	□	□
ETEC	■	■	■	□	■
ETEC - STEC	■	■	■	■	■
ETEC - STEC	■	■	■	□	■
ETEC - STEC	■	□	□	■	■
ETEC - STEC	■	□	□	■	■
ETEC - STEC	■	■	■	■	■
ETEC - STEC	□	□	□	■	■
ETEC - STEC	■	■	■	□	■
ETEC - STEC	□	□	□	■	■
ETEC - STEC	□	□	□	□	■
ETEC	■	■	■	□	■
ETEC	■	■	■	□	■
ETEC	□	□	□	■	■

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