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¿QUÉ ESPERAMOS? ¿A DÓNDE VAMOS? ENFERMEDADES EMERGENTES Y RESISTENCIA DE ANTIBIÓTICOS

CON EL AUSPICIO DE: USFQ

13, 14 Y 15 DE MAYO 2026

CENTRO DE CONVENCIONES METROPOLITANO
QUITO - ECUADOR

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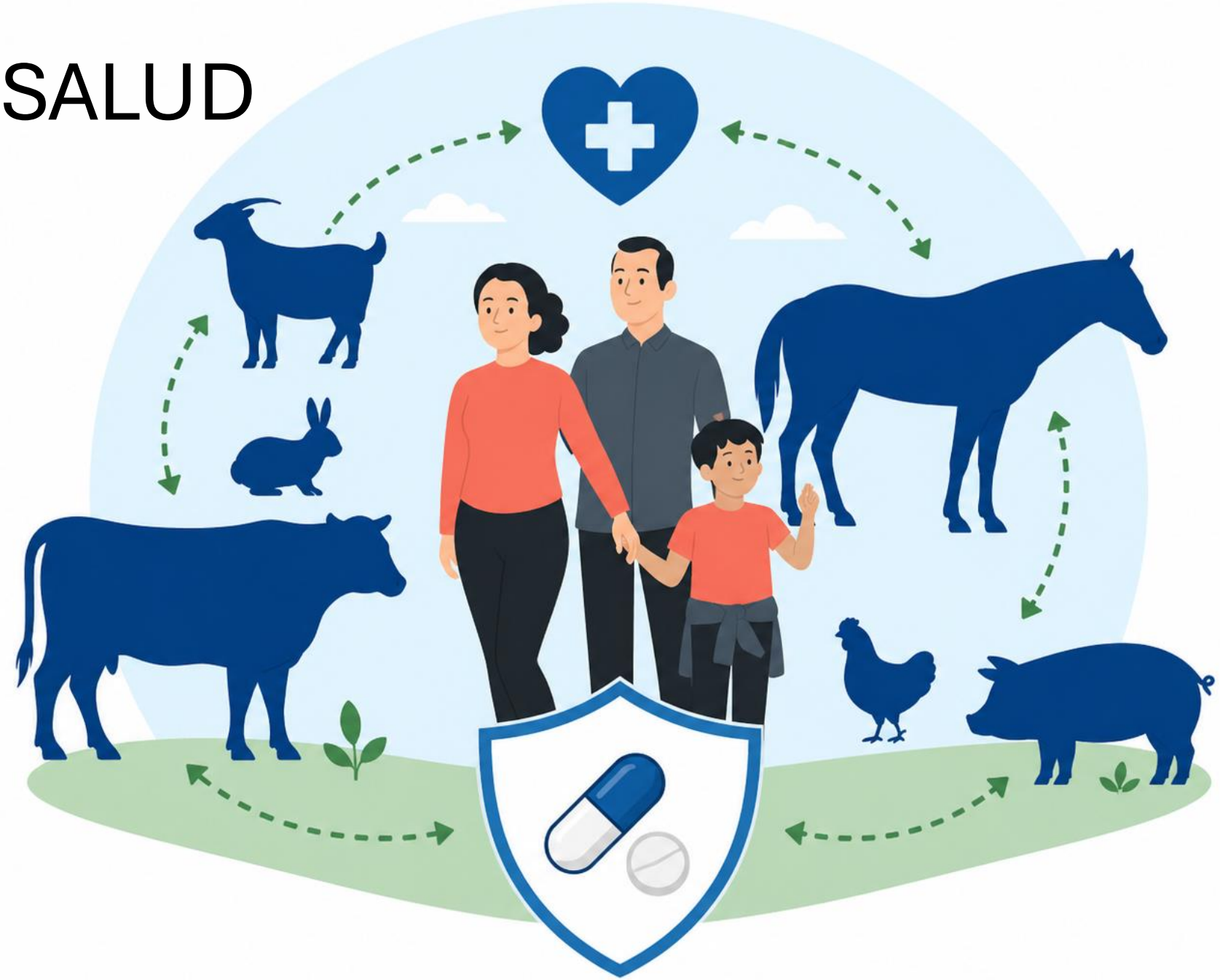
La industria de alimentos en el centro del mundo

Los antibióticos: ultima línea y no primera opción

Gabriel Trueba, MV, PhD

USFQ | INSTITUTO DE MICROBIOLOGÍA

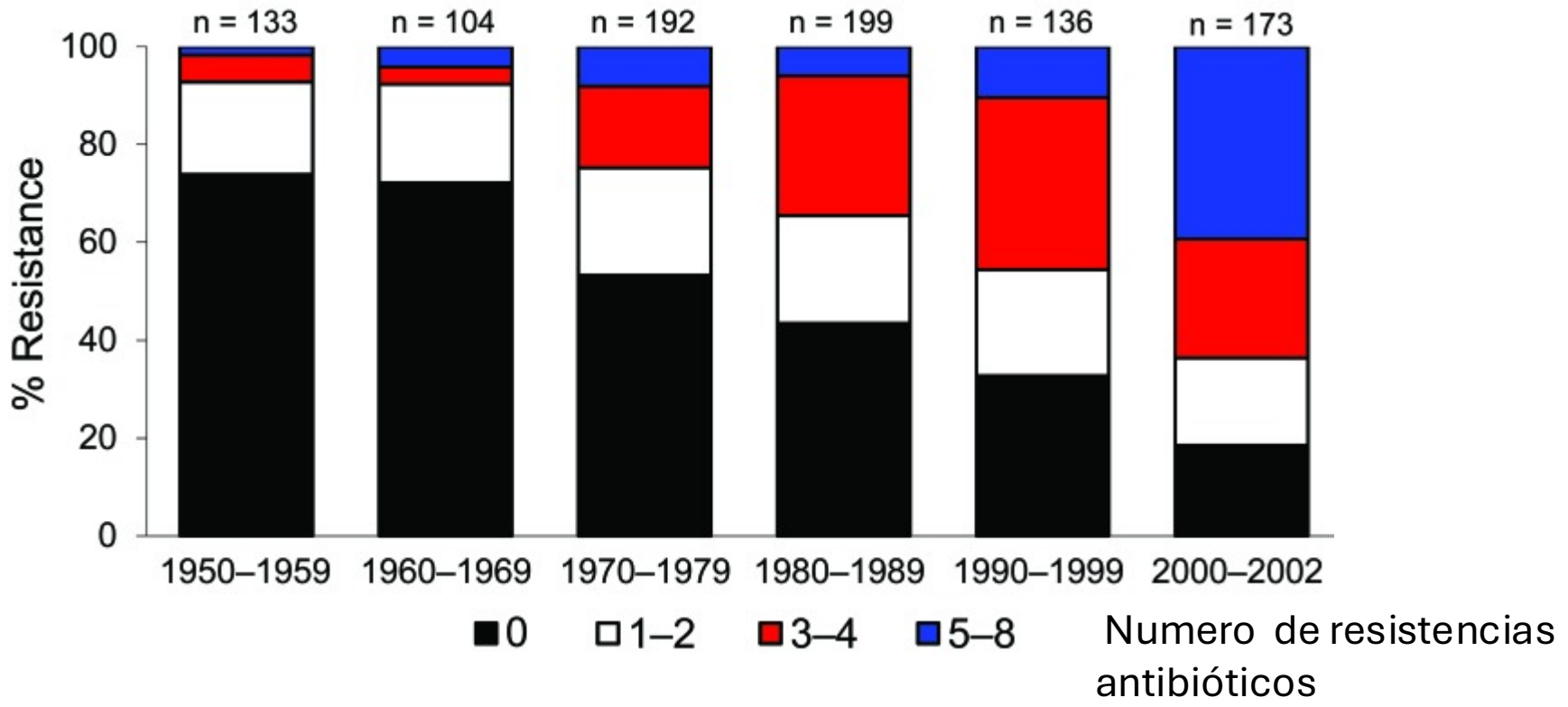
UNA SALUD



Mortalidad humana por resistencia a antibióticos

- 4.5 millones de muertes en 2021
- 40 millones de muertes durante los próximos 25 años
- COVID-19 mató a 7 millones de personas durante la pandemia

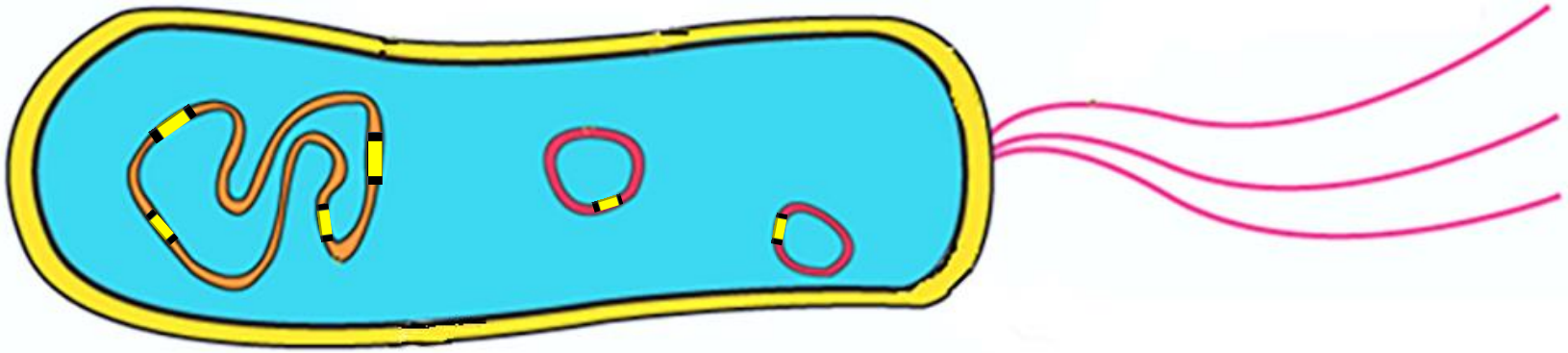
Cambios de resistencia a antibióticos *en E. coli* (Estados Unidos)

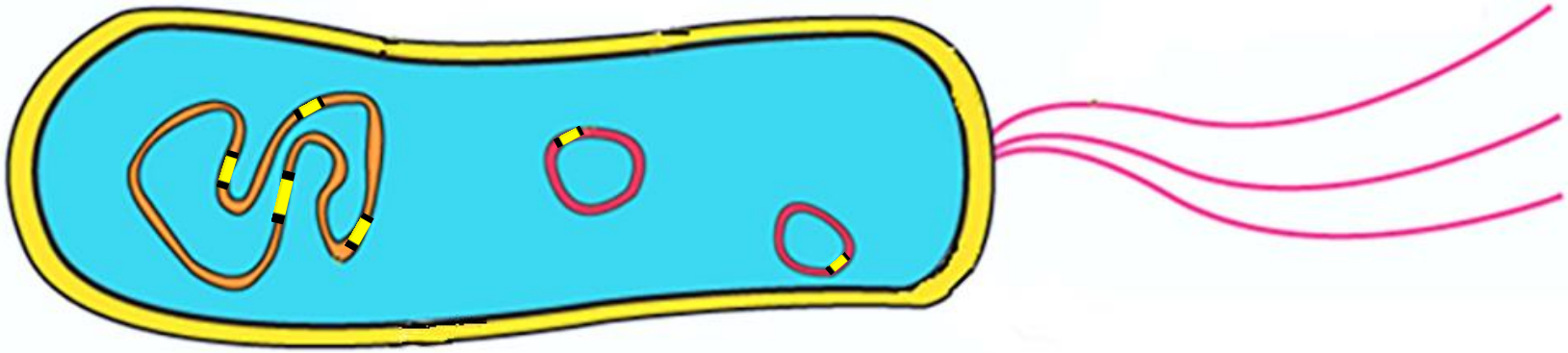


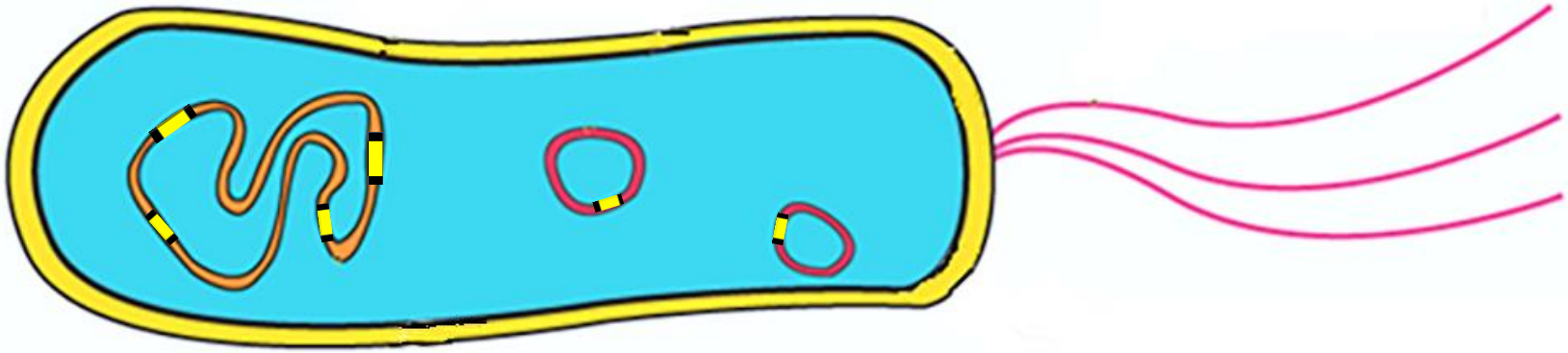
Emerg Infect Dis. 2012 May;18(5):741-9.

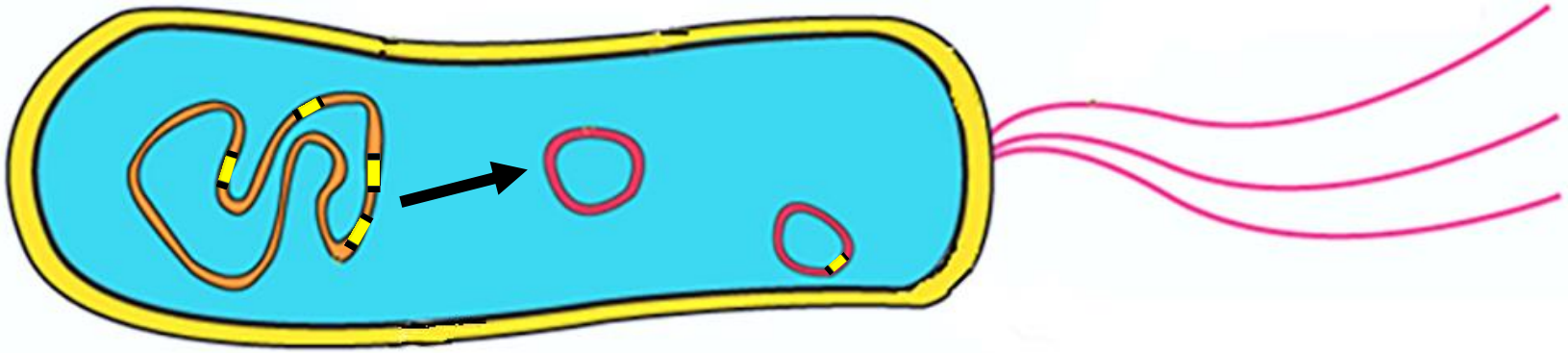
¿Cuál es el origen de los genes en bacterias?
Transferencia horizontal de genes

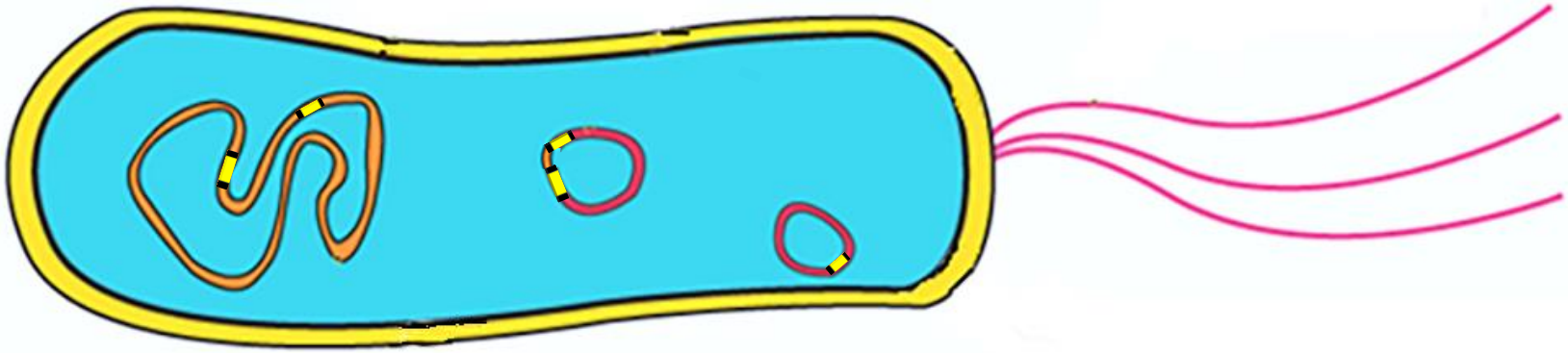
Cromosomas, plásmidos y transposones

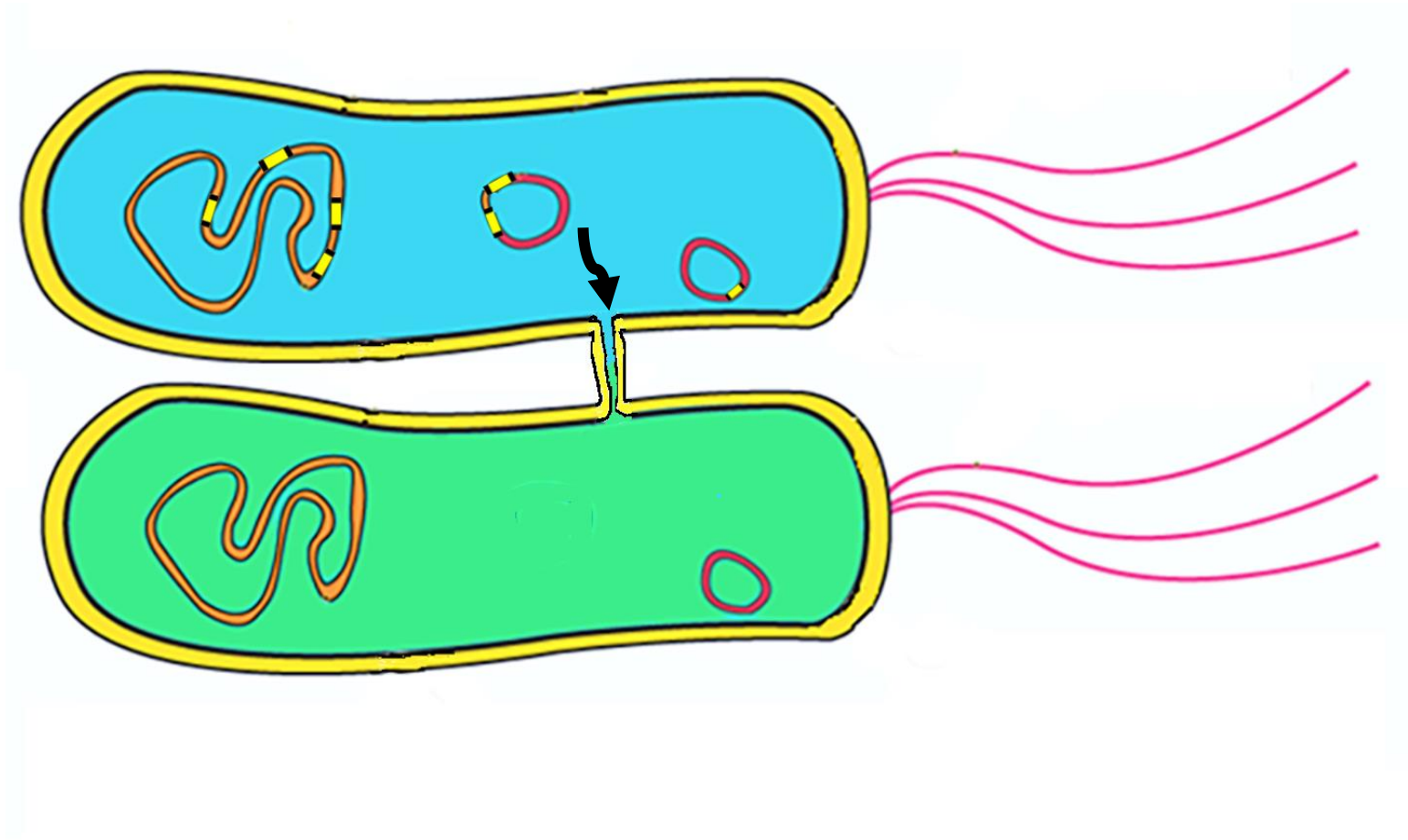




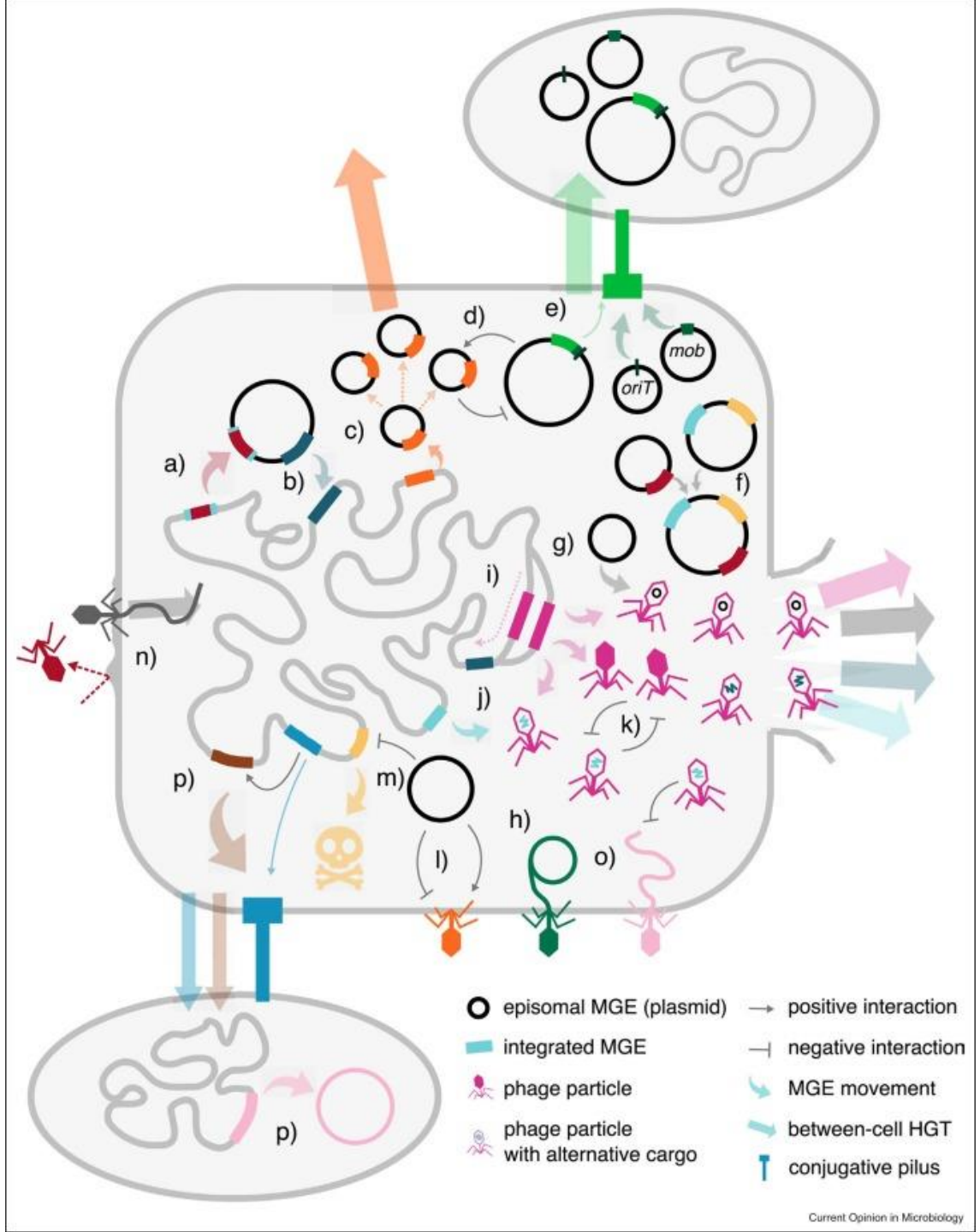








Elementos genéticos móviles: plásmidos transposones y bacteriófagos



La historia del gen *bla*$_{\text{CTX-M}}$:resistencia a cefalosporinas de 3$^{\text{era}}$ generación

Primer reporte de CTXM gene en *E. coli* 1989

A. Bauernfeind, H. Grimm, S. Schweighart

A New Plasmidic Cefotaximase in a Clinical Isolate of Escherichia coli

Summary: *Escherichia coli* GRI was isolated from an ear exudate of a newborn. The strain was highly resistant to cefotaxime (MIC 128 mg/l). Resistance to cefotaxime and the majority of β-lactam antibiotics was readily transferred to an *Escherichia coli* recipient strain. Both the wild type and the transconjugant strains are different in their resistance phenotype from TEM-3 β-cefotaximase producers by higher MICs to the majority of β-lactams and lower MICs to ceftazidime. The isoelectric point of the cefotaximase of *E. coli* GRI was 8.9 in comparison with 6.3 for TEM-3. Thus, the enzyme produced by *E. coli* GRI represents a new plasmidic (plasmid pMVP-3) broad spectrum β-lactamase (CTX-M) which may not be closely related to either the TEM- oder SHV-family of extended broad spectrum β-lactamases.

Zusammenfassung: *Eine neue plasmidische Cefotaximase in einem Escherichia coli Stamm. Escherichia coli* GRI wurde aus dem Ohrexsudat eines Neugeborenen isoliert. Der Stamm war hoch resistent gegenüber Cefotaxim (MHK 128 mg/l). Die Resistenz gegenüber Cefotaxim sowie den meisten übrigen β-Laktamantibiotika war leicht übertragbar auf einen anderen *Escherichia coli* Stamm. Sowohl der *E. coli* Wildtypstamm als auch die Transkonjuganten unterscheiden sich in ihrem Resistenzmuster von den TEM-3-cefotaximase produzierenden Stämmen, und zwar durch höhere MHK-Werte gegenüber der Mehrzahl der β-Laktamantibiotika, jedoch niedrigeren MHK-Werten für Ceftazidim. Zudem ist der isoelektrische Punkt der neuen Cefotaximase von *E. coli* GRI mit 8,9 gegenüber 6,3 für das TEM-3 Enzym deutlich verschieden. Deshalb liegt mit dem von *E. coli* GRI produzierten Enzym eine neue plasmidische (Plasmid pMVP-3) β-Laktamase (CTX-M) mit erweitertem Breitspektrum vor. Sie unterscheidet sich sowohl von den bisher beschriebenen Enzymen der TEM- als auch denen der SHV-Gruppe.

Introduction

Plasmid-coded β-lactamases were unable to confer resistance to third generation cephalosporins or aztreonam before the SHV-2 enzyme was first described in 1983 [1, 2]. From then on a series of new β-lactamases were discovered, mainly in Klebsiella [3]. They hydrolyse third generation cephalosporins and aztreonam to a various extent. As cefotaxime and ceftazidime are the most widely used third generation cephalosporins, a preliminary classification distinguishes between cefotaximases (such as TEM-3, [4]) and ceftazidimases (such as TEM-6 [5]) according to their relative activity against these two substrates. So far the TEM-3 cefotaximase has been the most widespread enzyme mainly in Klebsiella in France [6, 7]. In 1989 an *Escherichia coli* strain resistant to cefotaxime was isolated from the exudate of the ear of a newborn. The analysis of the β-lactamases of this *E. coli* strain indicates the appearance of an extended broad spectrum β-lactamase of the cefotaximase type clearly different from the TEM-3 enzyme (*Bauernfeind, A., Grimm, H., Schweighart, S.:* Extended broad spectrum beta-lactamase in a clinical isolate of *E. coli:* International Congress for Infectious Diseases, Montreal, July 15–19, 1990, Abstract-No. 570, p. 17).

Materials and Methods

Strains: Resistant wild-type strain: *E. coli* GRI from an exudate of the ear of a four-month-old child suffering from otitis media.
Recipient strain: *E. coli* A 15 R^- resistant to nalidixic acid (MIC = 1,024 mg/l).
Reference strains for isoelectric focussing: *E. coli* A 15 R^+ SHV-5 [8]; *Enterobacter cloacae* M 6300 [9]; *Klebsiella pneumoniae* CF 104 (TEM-3).
Minimal inhibitory concentrations (MICs): MICs were determined by an agar-dilution technique using Mueller-Hinton agar (Difco, Detroit, USA). The inoculum was 10^4 CFUs per spot deposited on the agar by a Denley multipoint inoculator. MICs were read after 16 h of incubation at 35 °C. *E. coli* ATCC 25922 was used as a quality reference strain.
Antimicrobial agents: Clavulanic acid (SmithKline Beecham Pharma); ceftazidime (Glaxo Pharmaceuticals, Ltd.); carumonam, ceftriaxone, cefetamet, trimethoprim and sulfamethoxazole (Hoffmann-La Roche Inc.); meropenem (ICI Pharmaceutical Inc.); cefoxitin (Merck Sharp and Dohme); piperacillin and tazobactam (Lederle Laboratories); cefotaxime, cefuroxime, cefpirome and tetracycline (Hoechst AG); cefixime and ceftizoxime (Fujisawa); cefoperazone and sulbactam (Pfizer); aztreonam (Squibb and Sons); cefmenoxime (Grünenthal); cefpodoxime (Sankyo Europe); cefprozil (Bristol-Myers); ceftibuten (Schering-Plough-Corporation); SCE 2728, parenteral cephalosporin (Takeda Chemicals Industries, Ltd.).
Transfer of resistance determinants: The donor strain and recipient strain (10^9 CFUs/ml per strain) were suspended in Mueller-Hinton broth (Difco, Detroit, USA) and incubated for 15 h at 35°C. Transconjugants were selected on MacConkey Agar (Oxoid, Wesel, FR Germany) supplemented with nalidixic acid (64 mg/l) to inhibit the growth of the donor strain and cefotaxime (0.5 mg/l) to inhibit the growth of the recipient strain.

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En 2013

Trends in Human Fecal Carriage of Extended-Spectrum β-Lactamases in the Community: Toward the Globalization of CTX-M

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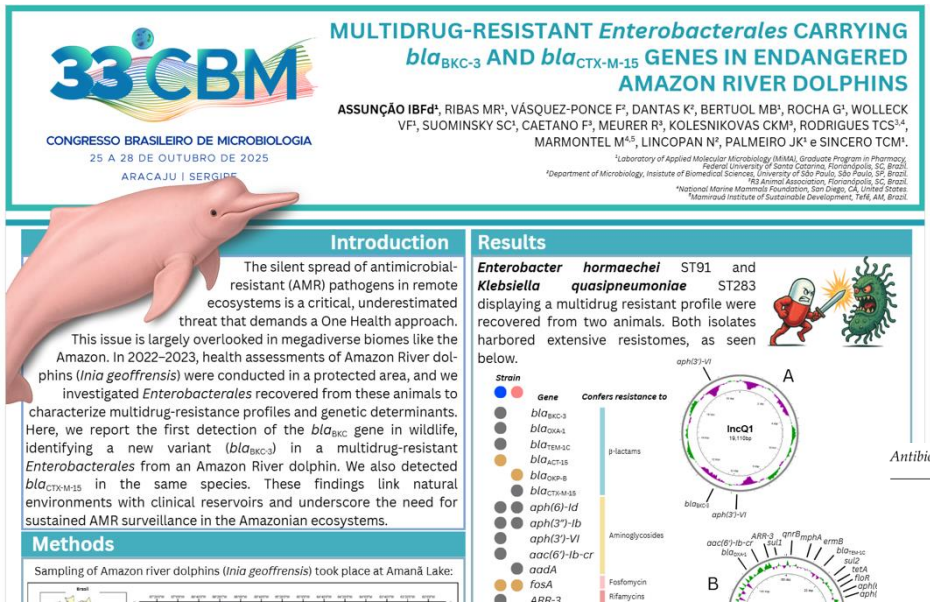
SUMMARY In the last 10 years, extended-spectrum β-lactamase-producing enterobacteria (ESBL-E) have become one of the main challenges for antibiotic treatment of enterobacterial infections, largely because of the current CTX-M enzyme pandemic. However, most studies have focused on hospitalized patients, though today it appears that the community is strongly affected as well. We therefore decided to devote our investigation to trends in ESBL-E fecal carriage rates and comprehensively reviewed data from studies conducted on healthy populations in various parts of the world. We show that (i) community ESBL-E fecal carriage, which was unknown before the turn of the millennium, has since increased significantly everywhere, with developing countries being the most affected; (ii) intercontinental travel may have emphasized and globalized the issue; and (iii) CTX-M enzymes, especially CTX-M-15, are the dominant type of ESBL. Altogether, these results suggest that CTX-M carriage is evolving toward a global pandemic but is still insufficiently described. Only a better knowledge of its dynamics and biology will lead to further development of appropriate control measures.



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Presence of Extended-Spectrum Beta-Lactamase-Producing *Escherichia coli* in Food-Producing and Companion Animals and Wildlife on Small-Holder Farms of Floreana Island, Galápagos Islands

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Human-Associated Extended-Spectrum β-Lactamase in the Antarctic

Jorge Hernández,[a,b] Johan Stedt,[b] Jonas Bonnedahl,[b,c] Ylva Molin,[a] Mirva Drobni,[a] Nancy Calisto-Ulloa,[d] Claudio Gomez-Fuentes,[d] M. Soledad Astorga-España,[d] Daniel González-Acuña,[e] Jonas Waldenström,[b] Maria Blomqvist,[b] and Björn Olsen[a,b]
Uppsala University, Uppsala, Sweden[a]; Linnaeus University, Kalmar, Sweden[b]; Kalmar County Hospital, Kalmar, Sweden[c]; University of Magallanes, Punta Arenas, Chile[d]; and University of Concepcion, Chillán, Chile[e]

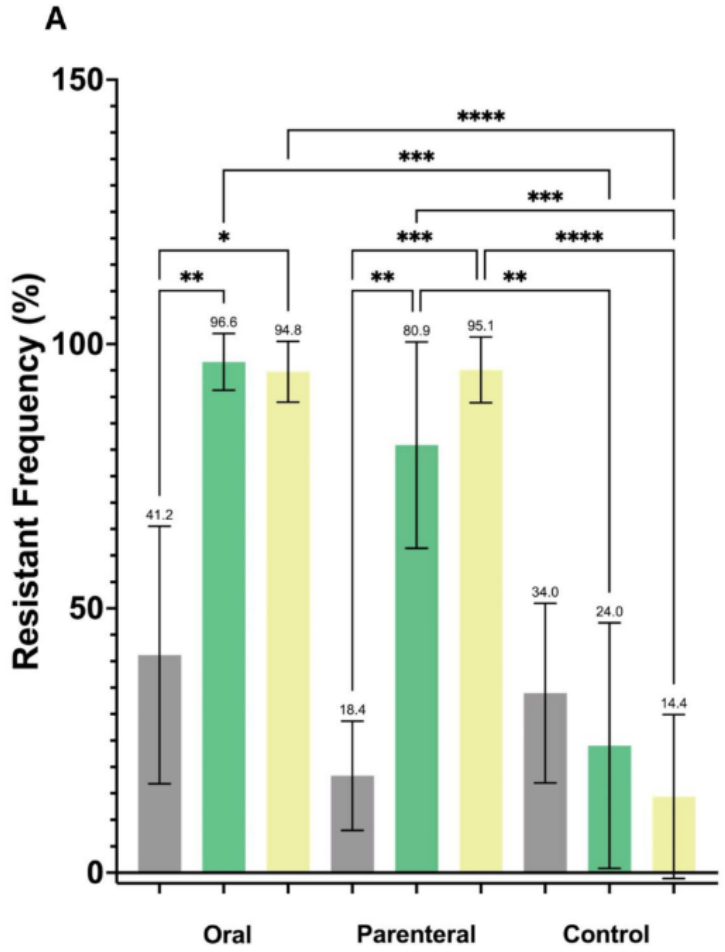
Escherichia coli **bacteria with extended-spectrum β-lactamase (ESBL) type CTX-M resistance were isolated from water samples collected close to research stations in Antarctica. The isolates had $bla_{CTX-M-1}$ and $bla_{CTX-M-15}$ genotypes and sequence types (ST) indicative of a human-associated origin. This is the first record of ESBL-producing enterobacteria from Antarctica.**

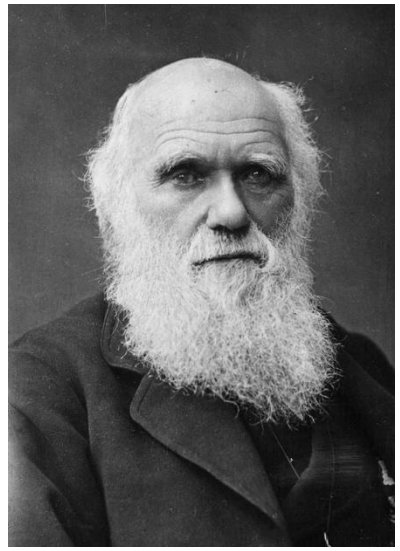
Table 3. List of antibiotic molecules and antibiotic resistance genes (ARGs), grouped by the main known antibiotic classes, found in the various studies on AMR in Arctic and Antarctic water samples covered in this review. The mode of action of the antibiotic class is indicated. The reference works, where the antibiotic molecules and/or the ARGs were investigated (screening) and/or detected (detection), are reported, with percentage values referring to the number of studies in the category per total number of analyzed studies (39).

Antibiotic Class	Mode of Action	Antibiotic Molecules	ARGs	References (Screening)	References (Detection)
Aminoglycosides	Protein Synthesis Inhibition	Amikacin, Gentamicin, Kanamycin, Kasugamycin, Neomycin, Netilmicin, Sisomicin, Streptomycin, Tobramycin	*aac(2′)-Ia/b/c, aac(2′)-IIa, aac(3), aac(3)-IIa, aac(3)-IVa, aac(3)-VIIIa, aac(3)-Ib, aac(3)-IIb, aac(3)-IIIc, aac(6′), aac(6′)-31/32, aac(6′)-Ia/b, aacC1/2/4/9, aadA, aadA1a/2/4/5/6/7/10, aadB, aadE, aadK, amrB, ant, ant(2″)-Ia, ant(3″)-Ia, ant(4′), ant(4′)-IIa/b, aph(2′)-Ib/d, aph(3′), aph(3′)-Ia, aph(3′)-IVa, aph(3′)-VIa, aph(3′)-Vb, aph(3″)-Ib (strA), aph(4)-Ia/b, aph(6), aph(6)-Ia, aph(6)-Id (strB), aph(9)-Ia, armA, cpaA, rpsL, strW, strX*	69% [13,27,28,52,54–59,61–64,66–68,70–72,76,79–81,84–86]	56% [13,21,27,28,52,54,56–59,61,63,66–68,70,72,76,79–81,86]
β-lactams Carbapenems Cephalosporins Monobactams Penicillins	Cell Wall Biosynthesis Inhibition	Ertapenem, Imipenem, Meropenem Cefaclor, Cefalotin, Cefazolin, Cefepime, Cefoxitin, Cefotaxime, Cefpodoxime, Ceftazidime, Ceftriaxone, Cefuroxime Aztreonam Amdinocillin, Amoxycillin, Ampicillin, Carbenicillin, Methicillin, Mezlocillin, Oxacillin, Penicillin G, Piperacillin	*ampC, blaACC, blaACT-1, blaADC-82, blaAST-1, bla-B, blaBIC-1, blaBIL-1, blaBJP-1, blaCAM-1, blaCARB-5/16, blaCFI, blaCIT, blaCKO-1, blaCMH-1, blaCMY-1/2/3/4/5/6/7/8/9/10/11, blaCTX-M-1/2/8/9/25/63, blaDHA-1/2/16, blaEBC, blaEC, blaEXO-1, blaFOX-1/2/3/4/5B, blaFTU-1, blaGES, blaIMP-1, blaKPC-9, blaLAT-1/2/3/4, blaMIR-IT, blaMOX-1/2/5, blaMSI-1, blaOXA-22/29/53/158/173/240/258/279/296/328/375/724, blaPDC-91, blaPER-2, blaPNGM-1, blaRAHN, blaROB-1, blaRTG, blaSGM, blaSHV, blaTEM, blaVEB, mecA, mecD, mrcA, pAmpCDHA, pAmpCFOX, pbpC, pbpE, per-I*	87% [13,27,28,52–64,66–68,70–73,76–86]	69% [27,52–64,67,68,71–73,76,77,79–84]
Chloramphenicol	Protein Synthesis Inhibition	Chloramphenicol, Florfenicol	*cat1/2/3/4, catA3/4/6/9/10/12/14/16, catB1/2/3/4/5/6/7/8/9, cfrA, cfrC, cmlA, cmlB, cml(E-5), cmlV, cmrA, cmrx, cmx, floR, pexA*	69% [13,27,28,52,54–59,61–64,66–68,70–72,76,79–81,84–86]	33% [27,52,54,61,62,64,66,68,71,72,76,79,86]
Fosfomycin	Cell Wall Biosynthesis Inhibition	Fosfomycin	*fosA, fosB, murA*	46% [27,28,54–58,62–64,66,68,71,72,76,79,80,85]	23% [27,54,56,62,68,71,72,79,80]

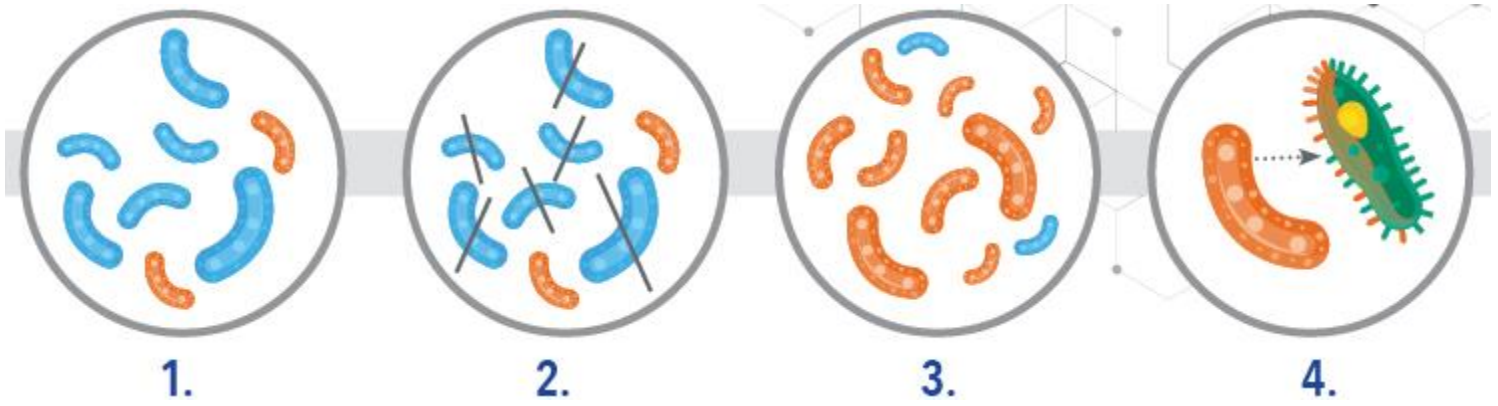
¿Porque este gen se disemino en el mundo?

¿Que pasa en el intestino cuando tratamos con antibióticos?





Selección Natural



Origen de la resistencia a cefalosporinas: suelo

Bacteria *Kluyvera* y hongo *Cephalosporium (Acremonium)*

Las bacterias tiene una “biblioteca” genética a su disposición

Año	Gen de Resistencia	Origen
2009	*bla*$_{\text{NDM-1}}$	*Acinetobacter spp.**
2001	*bla*$_{\text{KPC}}$	*Chromobacterium spp.**
1990s	*bla*$_{\text{CTX-M}}$	*Kluyvera spp.**
2015	*mcr-1*	*Moraxella spp.*

*Environmental bacteria

Los genes resistencia se transmite (entre bacterias) vía transposones y otros elementos genéticos móviles

- La comunidad bacteriana tiene o una biblioteca colectiva genética.
  - No importa si el gen este en una bacteria ambiental o intestinal

La Resistencia en patogenos cambia: Lugar y Tiempo

blaCTXM

TABLE 3 | Summary of results of 8 phenotypic studies on antimicrobial resistance of *P. multocida* from poultry.

Study	Reference (country)	Year of study	No. isolates (host species)	Testing method	Interpretation	Phenotypic resistance
1	(55) (India)	Not given	94 (chicken), 22 (duck), 4 (quail), 2 (turkey), 1 (goose)	Disk diffusion*	Disk manufacturer	PEN (49.6% R; 43.9% I), AMP (23.6% R; 22.8% I), CAB (59.3% R; 26.0% I), CN (23.6% R; 20.3% I), S (32.5% R; 44.7% I), AK (55.5% R; 19.5% I), C (6.5% R; 19.5% I), ERY (50.4% R; 49.6% I), LCM (2.4% R; 35.8% I), TE (24.4% R; 43.1% I), OTC (8.1% R; 30.1% I), DOX (25.2% R; 17.9% I), SDZ (100% R), TMP (39.0% R; 9.8% I), SXT (31.7% R; 13.8% I), CIP (8.9% R, 40.6% I), ENR (8.1% R; 20.3% I), NOR (8.1% R; 30.1% I), RIF (44.5% R; 25.2%), NIT (34.1% R; 26.0% I)
2	(56) (Indonesia)	1998–1999	9 (chicken)	Disk diffusion*	Not indicated	AMP (0% R), CN (11.1% R, 11.1% I), S (22% R, 66.7% I), ERY (22% R, 77.8% I), LCM (100% R), TE (55.6%R; 11.1% I), DOX (11.1% R, 11.1% I), SDZ (100% R), TMP (0% R), ENR (22.2% R, 11.1% I), BAC (44.4% R, 33% I)
3	(53) (Brazil)	Not given	56 (chicken, turkey)	Disk diffusion*	CLSI M31-A3 (2008)	AMX (1.8%), CEF (1.8%), CN (1.8%), ERY (5.4%), ENR (23.8%), TE (12.5%), SQN (76.8%), SXT (19.6%)
4	(58) (Egypt)	Not given	10 (chicken)	Broth microdilution*	NCCLS M31-A2 (2006)	AMX (100%), S (0%), FFN (0%), TE (100%), DOX (40%), SXT (0%), CIP (0%)
5	(33) (United States)	2001–2003	80 (chicken)	Broth microdilution*	CLSI M31-A2 (2002), NARMS (2006)	AMC (1.2% R), AMP (1.2% R), TIC (0% R), CFN (1.2% R), CEF (1.2% R), CN (2.5% R), SPC (1.2% R), TIM (2.5% R), FFN (1.2% R), TE (6.2% R), SXT (0% R), ENR (1.2% R), DIF (1.2% R), ORB (1.2% R)
6	(57) (Hungary)	2005–2008	7 (geese), 7 (duck), 1 (muscovy duck), 3 (turkey), 1 (chicken), 1 (pheasant)	Disk diffusion*	NCCLS M2-A8 (2003)	PEN (0% R), CQN (0% R), APR (15.0% R; 40.0% I), NEO (15.0% R), ERY (0% R; 40.0% I), TUL (0% R), C (0% R), FFN (0% R), TE (15.0% R; 5% I), DOX (0% R; 5% I), FLM (40.0% R), ENR (0% R), OXO (40.0% R), SXT (20.0% R), COL (0% R)
7	(54) (Brazil)	Not given	99 (chicken), 13 (Japanese quail)	Disk diffusion*	CLSI M31-A3 (2008)	AMP (3.4% R), CFN (1.6% R), AK (1.6% R), TE (5.1% R)
8	(52) (United States)	2006–2011	207 (chicken)	Broth microdilution	CLSI M31-A2 (2002)	PEN (16.0% R; 16.0% I), AMX (5.0% R; 2.0% I), CEF (3.0% R; 2.0% I), NEO (2.0% R; 9.0% I), CN (6.0% R; 15.0% I), ERY (18.0% R; 78.0% I), TYL (97.0% R; 2.0% I), CLD (97.0% R; 3.0% I), FFN (2.0% R; 4.0% I), TE (9.0% R; 5.0% I), DOX (1.0% R; 0% I), OTC (9.0% R; 5.0% I), STZ (5.0% R; 3.0% I), SDX (9.0% R; 6.0% I), SXT (2.0% R; 2.0% I), ENR (1.0% R; 6.0% I)

(2017) Antimicrobial Resistance in Bacterial Poultry Pathogens: A Review. Front. Vet. Sci. 4:126. doi: 10.3389/fvets.2017.00126

TABLE 4 | Summary of results of 7 phenotypic studies on antimicrobial resistance of *A. paragallinarum* from poultry.

Study	Reference (country)	Year of study	No. isolates	Testing method	Interpretation	Phenotypic resistance
1	(63) (Indonesia)	1991–1999	14	Disk diffusion[a]	NCCLS (1984)	AMP (7.1% R), NEO (71.4% R), S (78.6% R), ERY (78.6% R), OTC (57.1% R), DOX (35.7% R), SXT (21.4% R)
2	(64) (Taiwan)	1990–2003	18	Broth micro dilution	(8)	AMP (38.9% R), NEO (83.3% R), S (88.9% R), ERY (77.8% R), SXT (83.3% R)
3	(68) (Uganda)	Not given	5	Agar dilution	(8)	AMP (60% R), NEO (0%), S (60% R), C (0%), TE (80% R), SMX (60% R)
4[b]	(65) (Thailand)	1990–2009	18	Disk diffusion	CLSI M31-A3 (2008)	PEN (27.8% R; 27.8% I), CLX (100%), AMP (33.3% R; 5.5% I), AMX (27.8%), AMC (0%), CEF (27.8%), NEO (100%); CN (5.5% R; 11.1% I), SPC (11.1%), ERY (77.8% R; 16.7% I), TYL (0% R; 5.5% I), LCM (100%), OTC (55.6% R; 5.5% I), DOX (38.9% R; 11.1%), SXT (66.7%), ENR (27.8% R; 11.1% I)
5[b]	(66) (Thailand)	1990–2009	18	Broth micro dilution[a]	CLSI M100-S21 (2011) and (8)	AMP (5.6% R), AMX (0%), CEF (5.6% R), ERY (66.7% R), CN (55.6% R), S (66.7% R), SPC (50% R), OTC (72.2% R), DOX (66.7% R), SXT (66.7% R), CIP (66.7% R), ENR (50% R)
6	(5) (Mexico, Ecuador, Peru, Panama)	Not given	66	Disk diffusion[a]	(65)	PEN (26.0% R), AMC (4.7% R), AMP (5.9% R), S (62.1% R), CN (46.8% R), NEO (56.2% R), KA (24.5% R), ERY (73.0% R), LCM (81.5% R), TE (37.8% R), SXT (19.6% R), COL (22.8% R), FOM (1.6% R)
7	(67) (India)	Not given	4	Disk diffusion	Not given	AMP (100% R), AMC (0%), NEO (100% I), S (100% I), C (0%), TE (100% R), OTC (100% R), DOX (100% R), SXT (0%), FUR (100% I), ENR (0%), CIP (0%), PEF (0%)

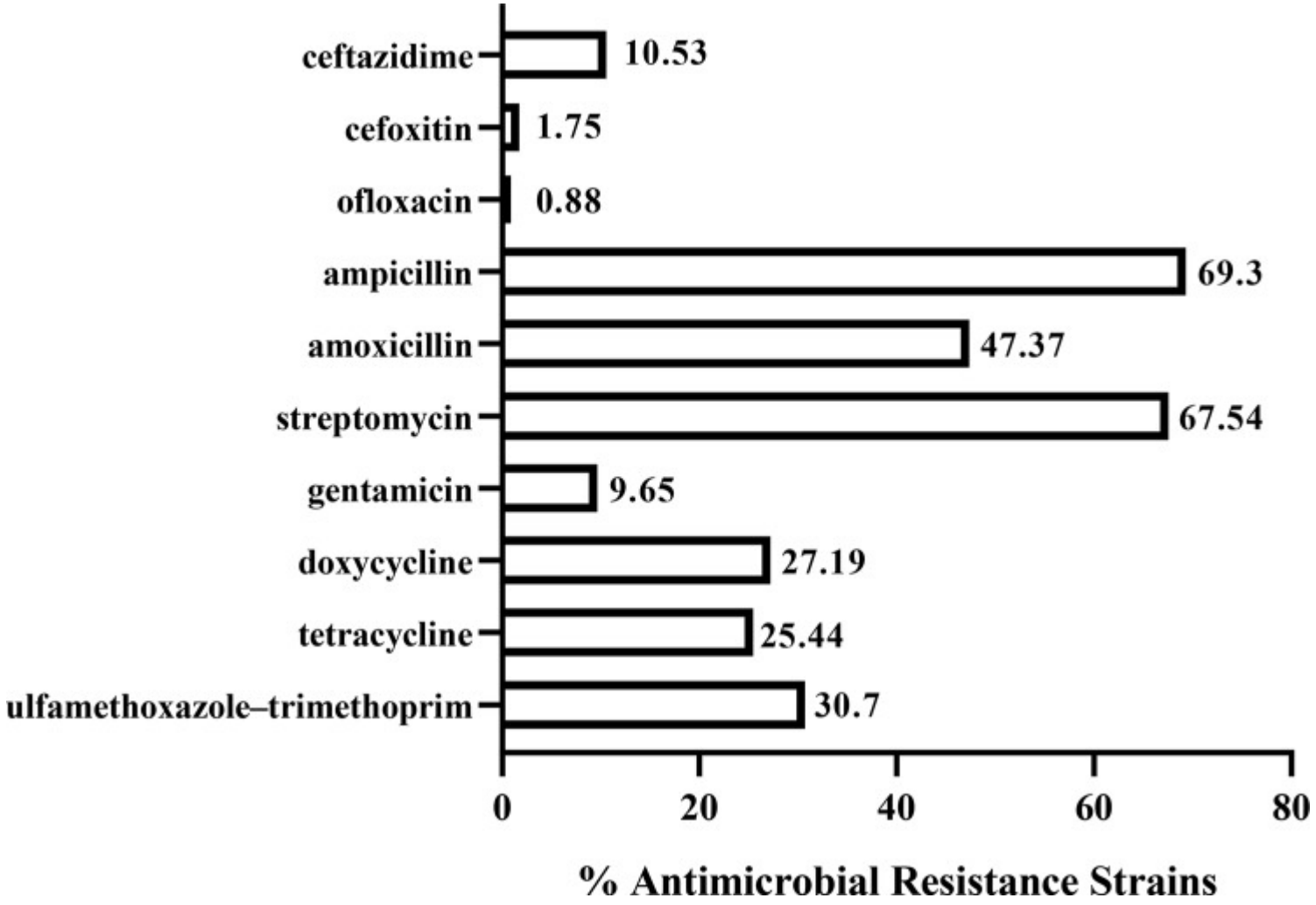
In studies where intermediate susceptibility is given, results are presented as: R, fully resistant; I, intermediate resistant.

Nhung NT, Chansiripornchai N and Carrique-Mas JJ (2017) Antimicrobial Resistance in Bacterial Poultry Pathogens: A Review. Front. Vet. Sci. 4:126. doi: 10.3389/fvets.2017.00126

TABLE 2 | Summary of results of 7 phenotypic studies on antimicrobial resistance of *S*. Pullorum/Gallinarum from poultry.

Study	Reference (country)	Year of study	No. isolates (bacterial spp.)	Testing method	Interpretation	Phenotypic resistance
1	(41) (Korea)	1995–2001	258 (SG)	Disk diffusion test[a]; agar diffusion[b]	NCCLS M31-A (2000)	AMP (13.0%), AMC (3.9%), CN (43.4%), KA (69.6%), TE (74.8%), OTC (77.9%), SXT (1.5%), COL (0.4%), ENR (6.5%), CIP (10.9%), NOR (52.5%), OFL (82.6%)
2	(43) (Korea)	2010–2012	26 (SG)	Disk diffusion test[a]	CLSI M100-s22 (2012)	AMP (0%), CFZ (0%), AMC (0%), CFN (0%), FOX (0%), CTX (0%), IMP (0%), CN (0%), S (0% R; 88.5% I), AK (0%), ERY (100% R), TE (0%), SXT (0%), C (0%), CIP (0%), ENR (0%), NOR (0%)
3	(44) (Korea)	2002–2007	105 (SG)	Agar dilution test	CLSI M31-A2 (2002), CLSI[c] (2006), DAMR (2006)	AMP (41.9% R), AMX (24.8% R), S (54.3% R), CN (45.7% R), NEO (7.8% R), TE (16.2% R), SMX (36.2% R), NA (98.1% R), ENR (10.5% R; 83.8% I)
4	(47) (Brazil)	2006–2013	32 (SP/SG)	Disk diffusion[a]	CLSI M31-A2 (2002); CLSI M100-S23 (2013)	AMC (0%), CTX (0%), IMP (0%), CAZ (0%), CFP (0%), ETP (0%), CEF (0%), TE (6.3% R), C (0%), FFN (0%), SXT (1%), NA (37.5%), CIP (34.4%), ENR (25.0%)
	(47) (Brazil)	2006–2013	18 (SP)	Disk diffusion[a]	As above	AMC (0%), CTX (0%), IMP (0%), CAZ (0%), CFP (0%), ETP (0%), CEF (0%), ETP (0%), TE (0%), C (0%), FFN (0%), SXT (0%), NA (38.9%), CIP (33.3%), ENR (5.6%)
5	(48) (China)	1962–2010	337 (SP)	Disk diffusion[a]	CLSI M100-S22 (2012)	AMP (34.4%), CAB (25.5%), CFM (46.6%), CTX (2.4%), S (61.7%), CN (5.3%), KA (3.9%), SPC (45.0%), C (4.1%), TE (58.7%), SMX (52.8%), TMP (82.8%), SXT (49.4%), NA (69.0%), CIP (4.5%), NIT (26.4%)
6	(45) (India)	Not given	4 (SG)	Disk diffusion[a]	CLSI M100-S25 (2013)	AMP–SBT (0%), AMC (0%), CRO (0%), AK (0%), S (0%), CN (0%), TE (0%), DOX (0%), ERY (0%), AZI (0%), C (0%), SXT (0%), CIP (0%), ENR (0%), COL (0%)
7	(46) (India)	2009–2010	12 (SG)	Disk diffusion[a]	Disk manufacturer	AMP (8.3% R; 33.4% I), AMC (0% R; 8.3% I), CLX (0% R; 41.7% I), CN (0% R; 8.3% I), KA (0% R; 66.7% I), NEO (0% R; 58.3% I), TE (16.7% R; 83.3% I), ERY (100% R), C (0% R; 33.4% I), SXT (0% R; 33.4% I), NA (75.2% R; 33.4% I), ENR (0% R; 25.0% I), CIP (0% R; 16.7% I), OFL (0% R; 25.0% I), COL (0% R; 16.7% I)

Salmonella gallinarum China

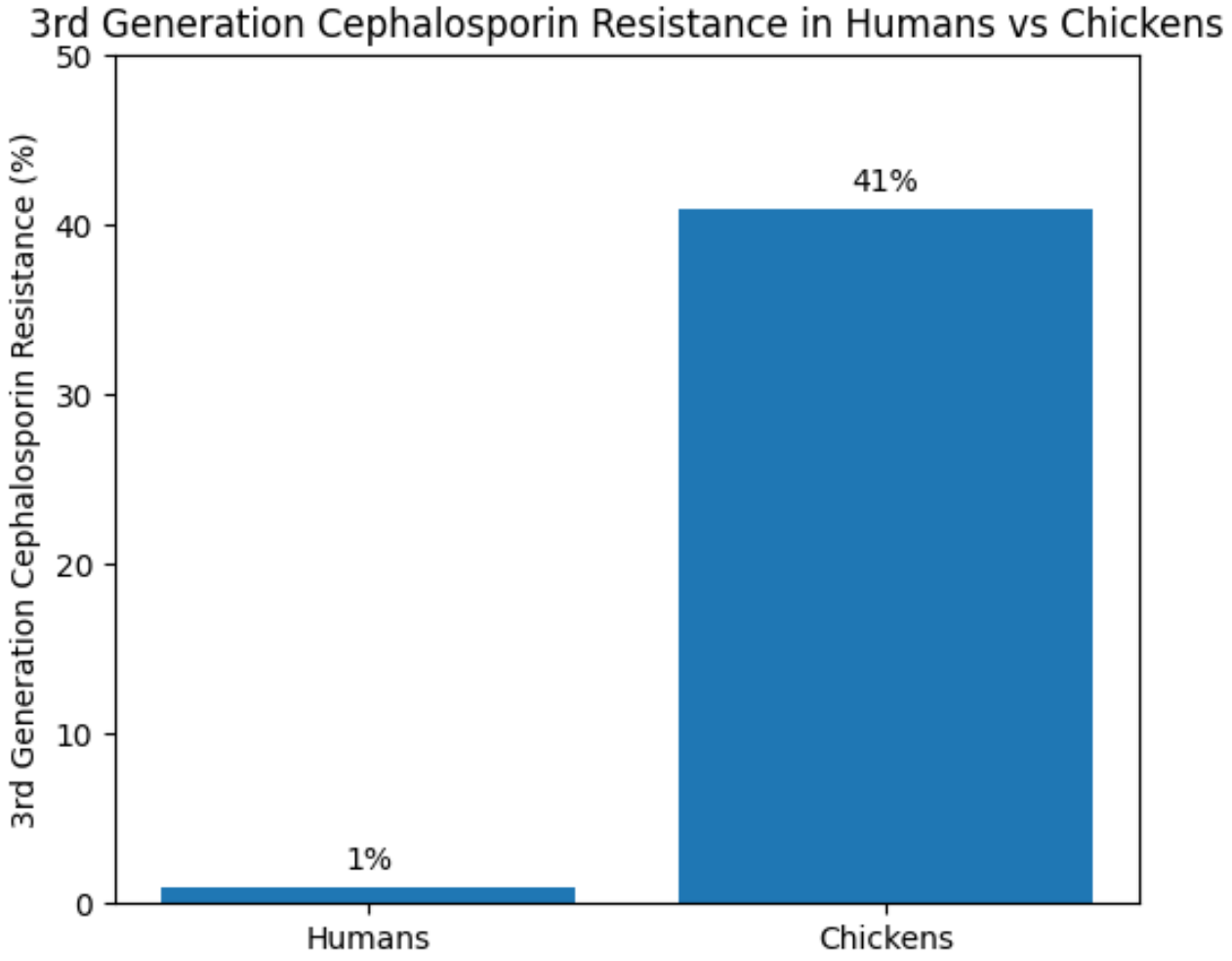


.BMC Microbiol 2024 Oct 18;24:414. doi: 10.1186/s12866-024-03296-3

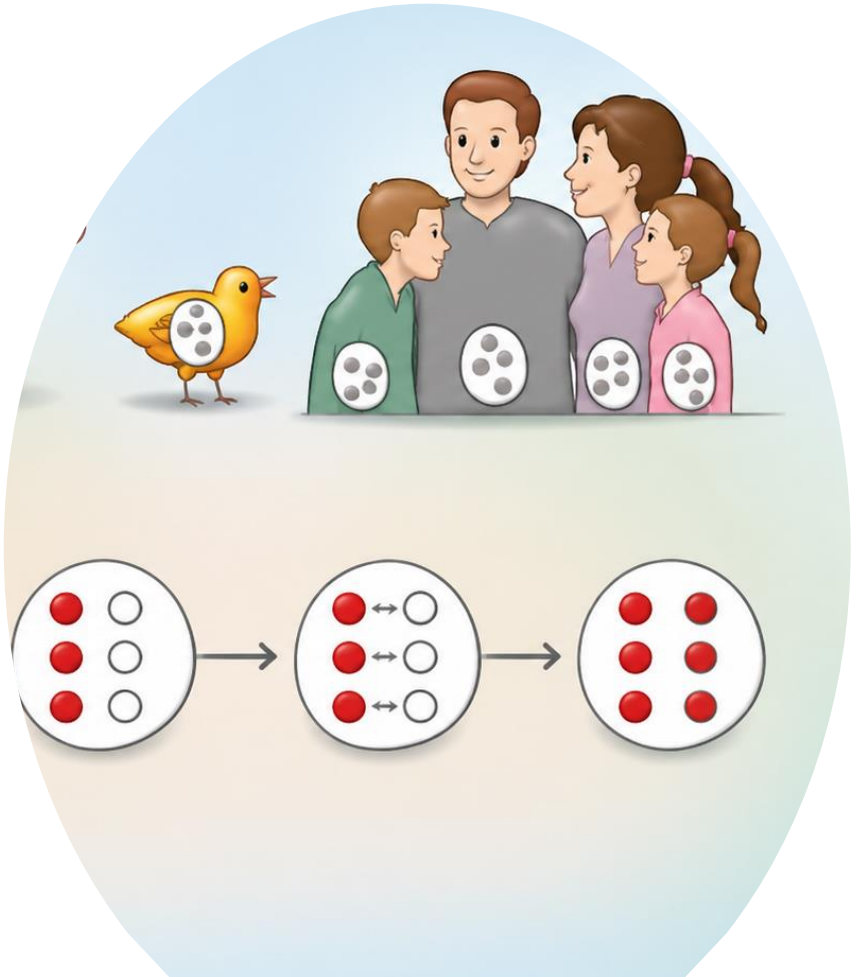
La crisis de resistencia a antibióticos y la Medicina Veterinaria

Proporción de coliformes en intestino (humano y aviar) resistentes a ceftriaxona en Quito

Datos preliminares
(n=20)



Evidencia genética de movilización de genes de Resistencia a cefalosporinas de 3ra generación entre bacterias de humanos y pollos



Escherichia coli de pollos a humanos

34- 54% de huevos tienen *E. coli (*de pollos)

Conclusiones

- Evidencia creciente de que la resistencia en bacterias de pollos pasa a bacterias de humanos
- Los antibióticos deben ser la ultima línea y no la primera opción
  - No se puede usar antibióticos para prevenir infecciones
  - Antibióticos deben usarse únicamente para tratar infecciones
- Alternativas a antibióticos para control de ciertas enfermedades
  - Bacteriófagos
  - Vacunas
  - Bioseguridad