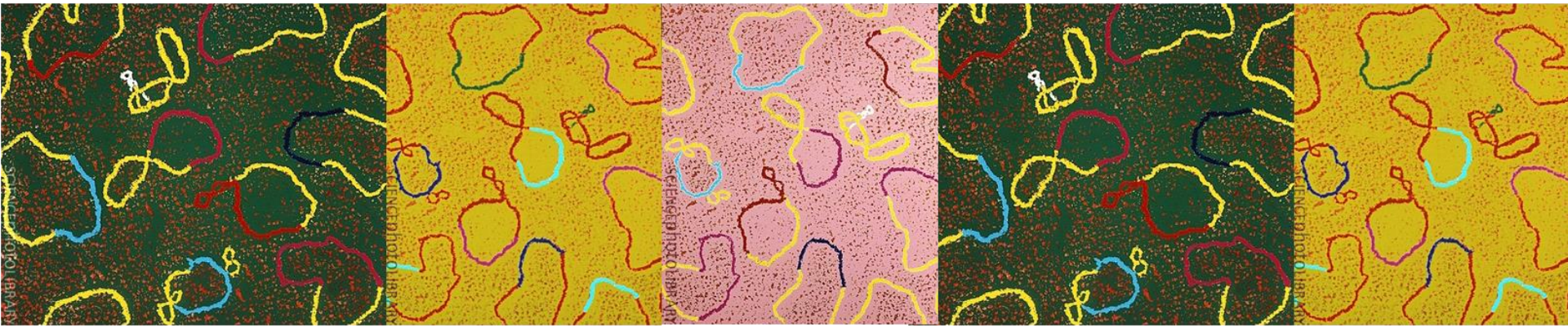
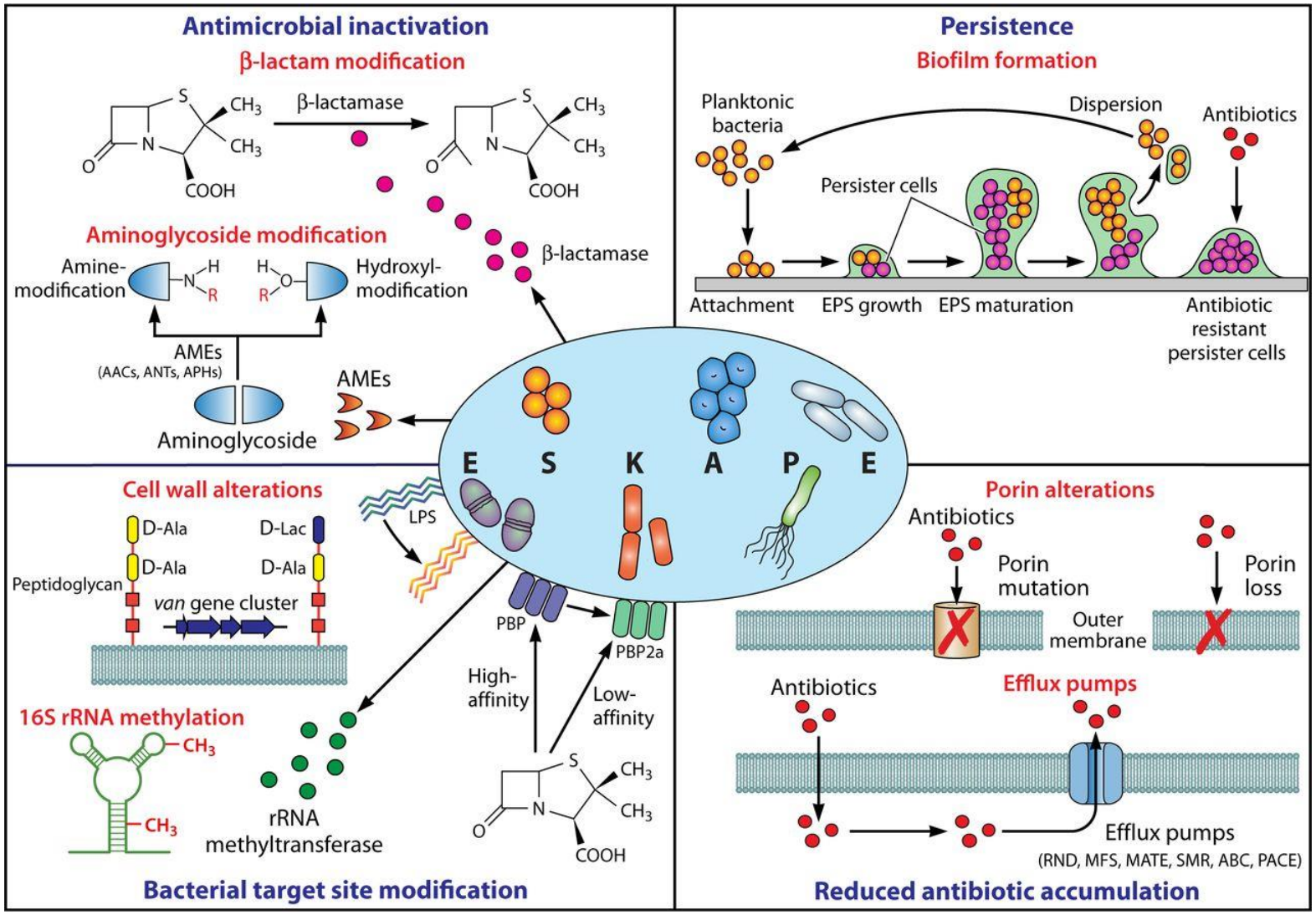
Genetica e Comunicazione Batterica



Alessandra Carattoli
Dip. Medicina Molecolare
Sapienza Università di Roma

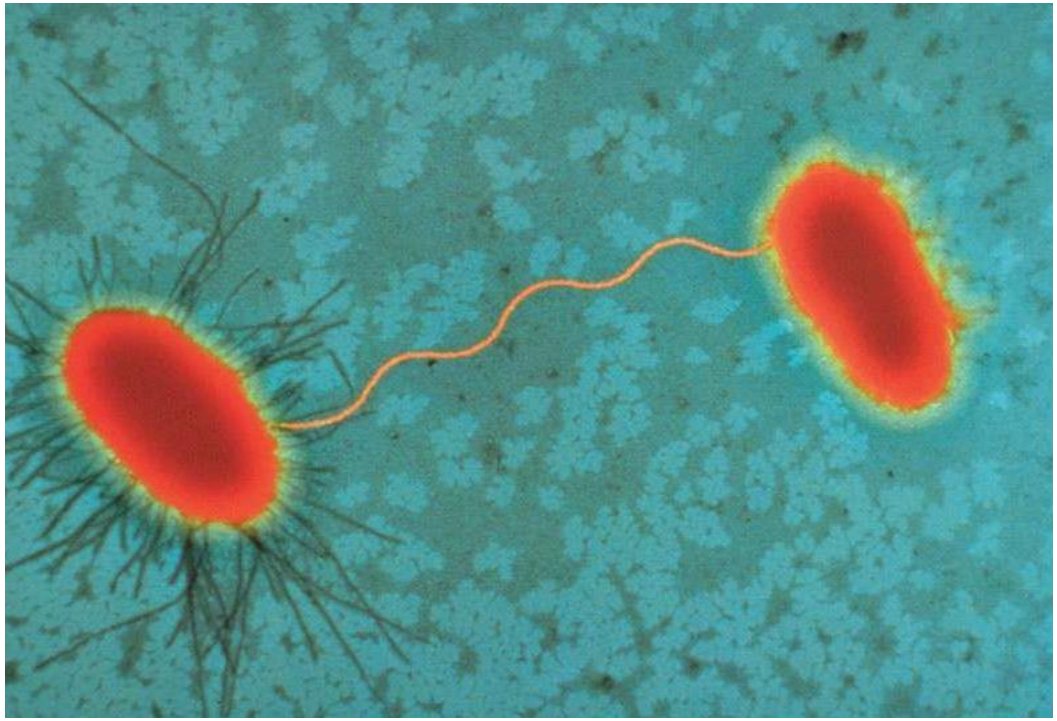
Antimicrobico-resistenza, cure e ambiente
BATTERI CONNESSI
15/6/2021

Genetica della resistenza agli antibiotici

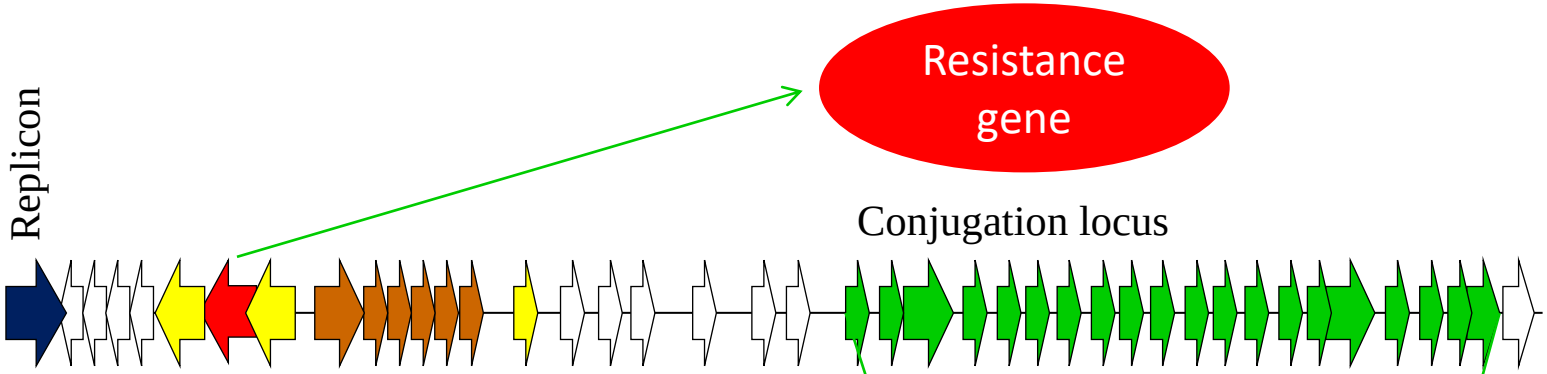


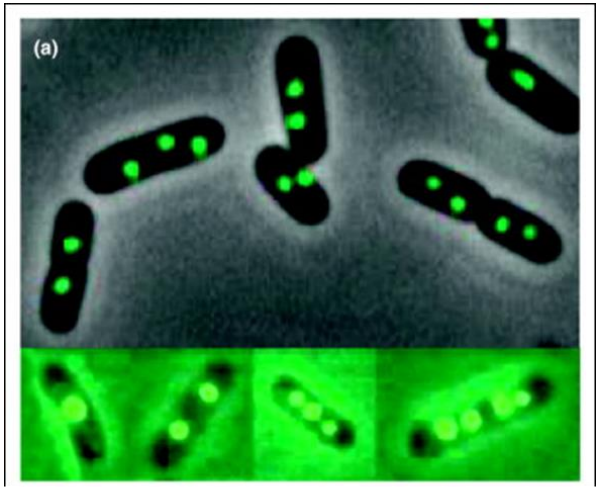
David M. P. De Oliveira et al. Clin. Microbiol. Rev. 2020; doi:10.1128/CMR.00181-19

Bacterial sex



Self-conjugative plasmid (30-300 kb)



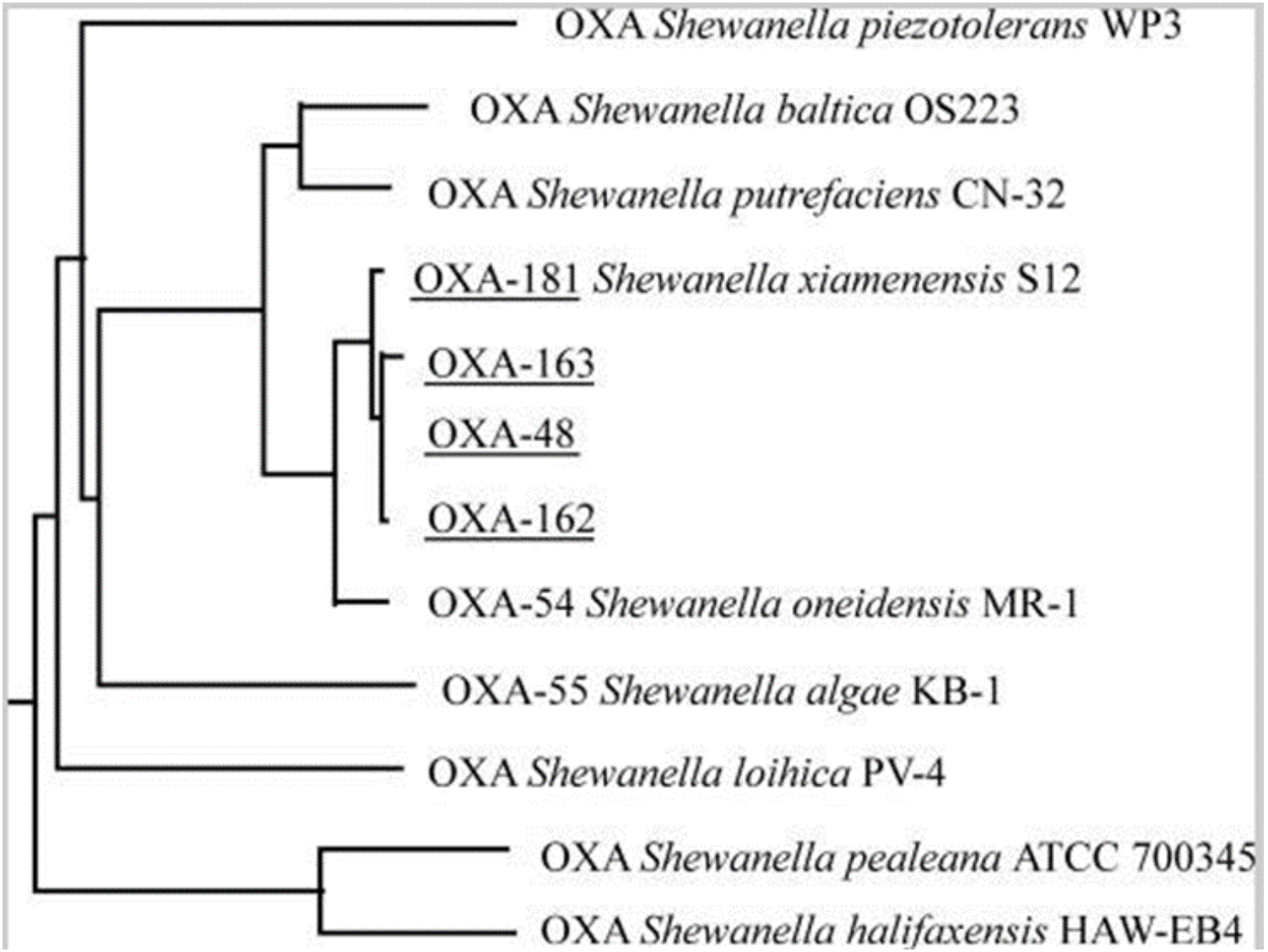


Szardenings F et al., 2011. Current Opinion in Microbiology 14 (6): 712-718

replication stability conjugation resistance Mobile elements other

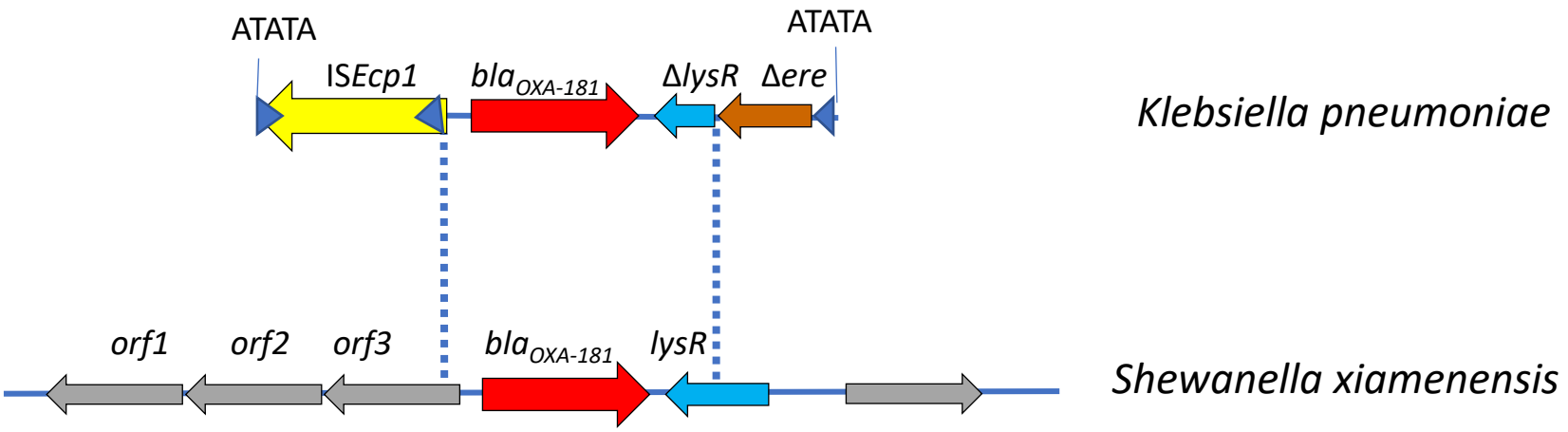
Una storia di plasmidi tra *Shewanella* *Klebsiella pneumoniae* e *Escherichia coli*

Class D carbapenemases



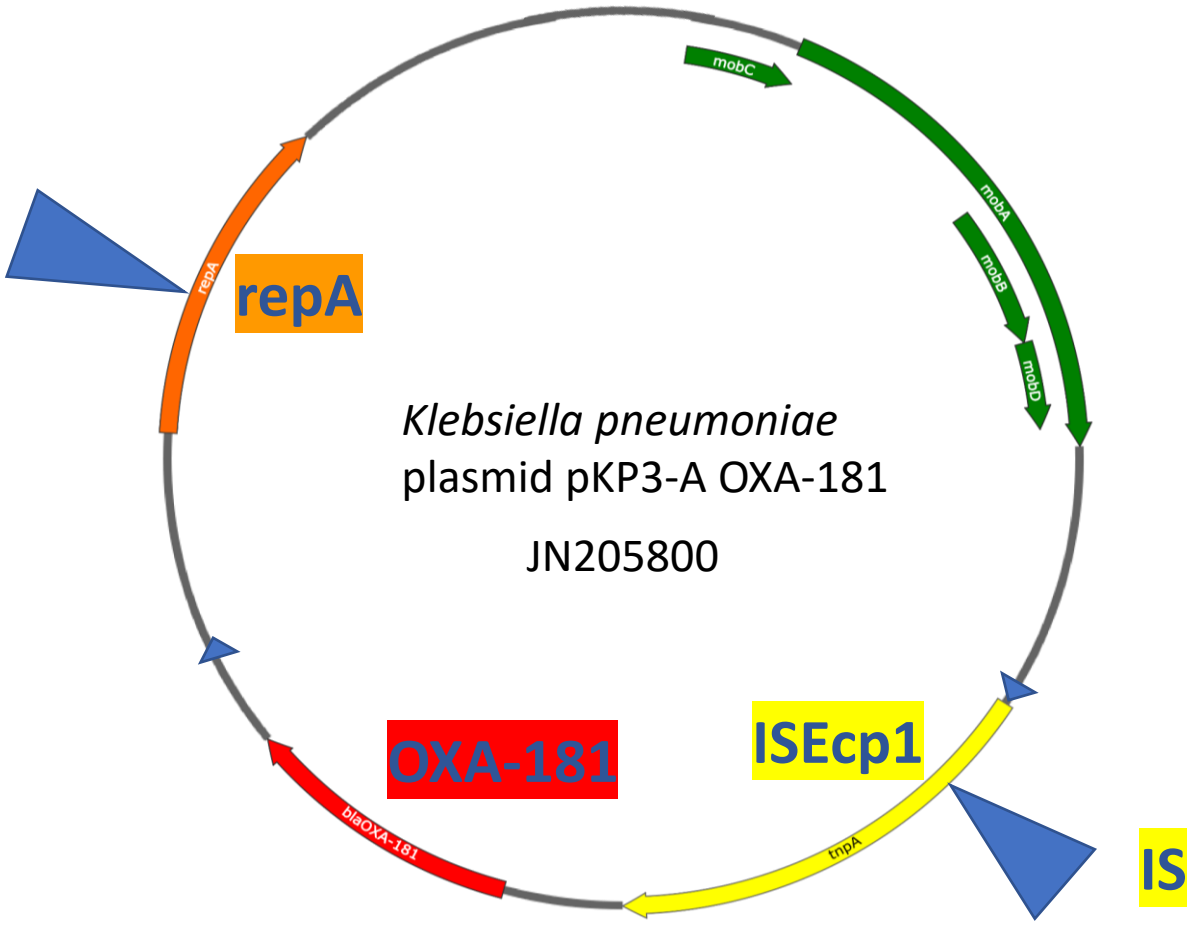
Potron *et al., AAC 2011, 55: 4405–4407*

The origin of *bla*$_{OXA-181}$



Potron *et al., AAC 2011, 55: 4405–4407*

ColKP3 9 Kb


mobC
mobA
mobB
mobD
repA
repA
Klebsiella pneumoniae
plasmid pKP3-A OXA-181
JN205800
OXA-181
blaOXA-181
ISEcp1
tnpA
IS

Klebsiella pneumoniae pOXA-181_29144
KX523903 Czech Republic

Escherichia coli
pOXA181
KP400525 China

FDAARGOS_433
CP023897 Canada

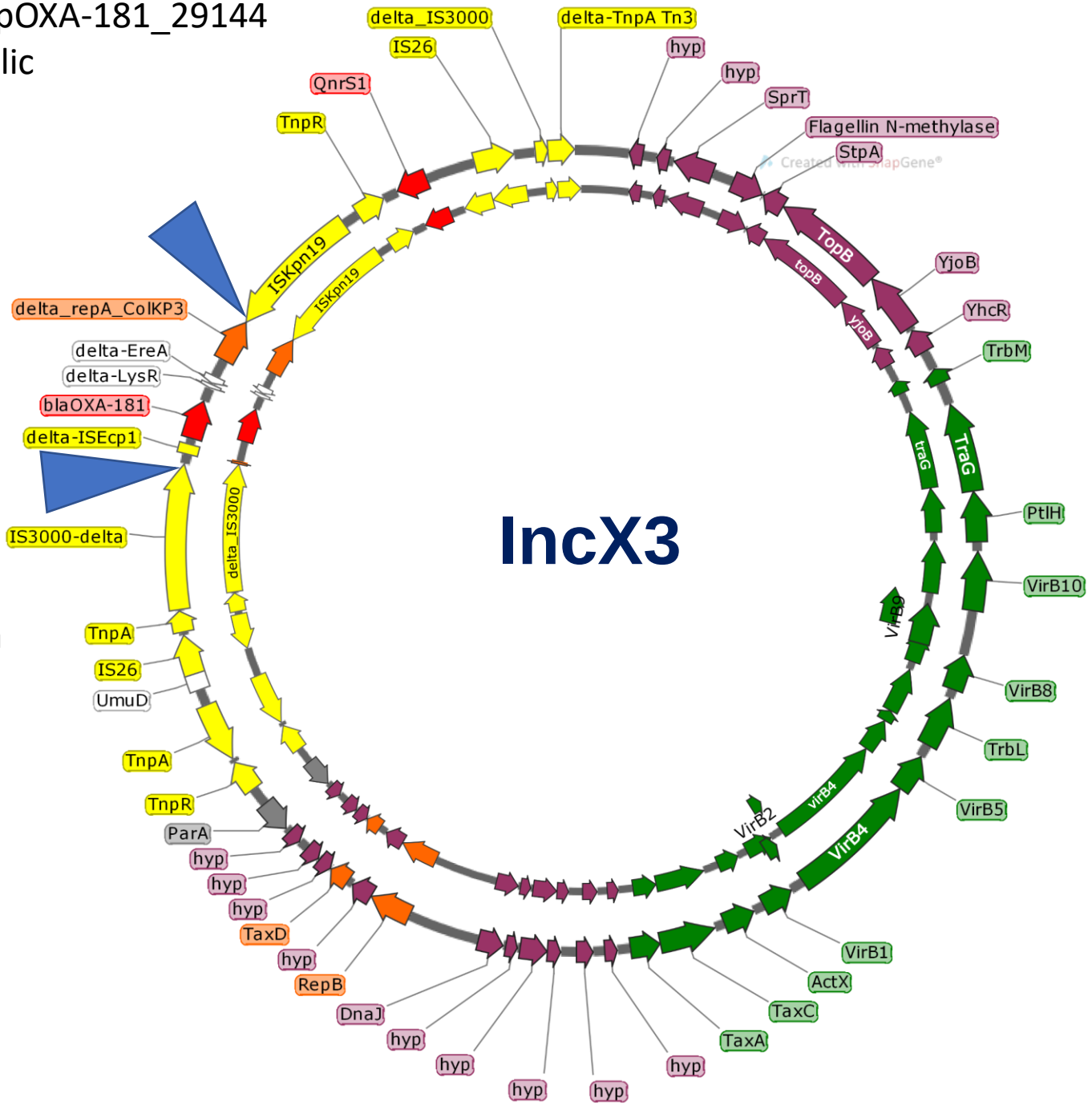
pAMA1167-OXA-181
CP024806, Denmark

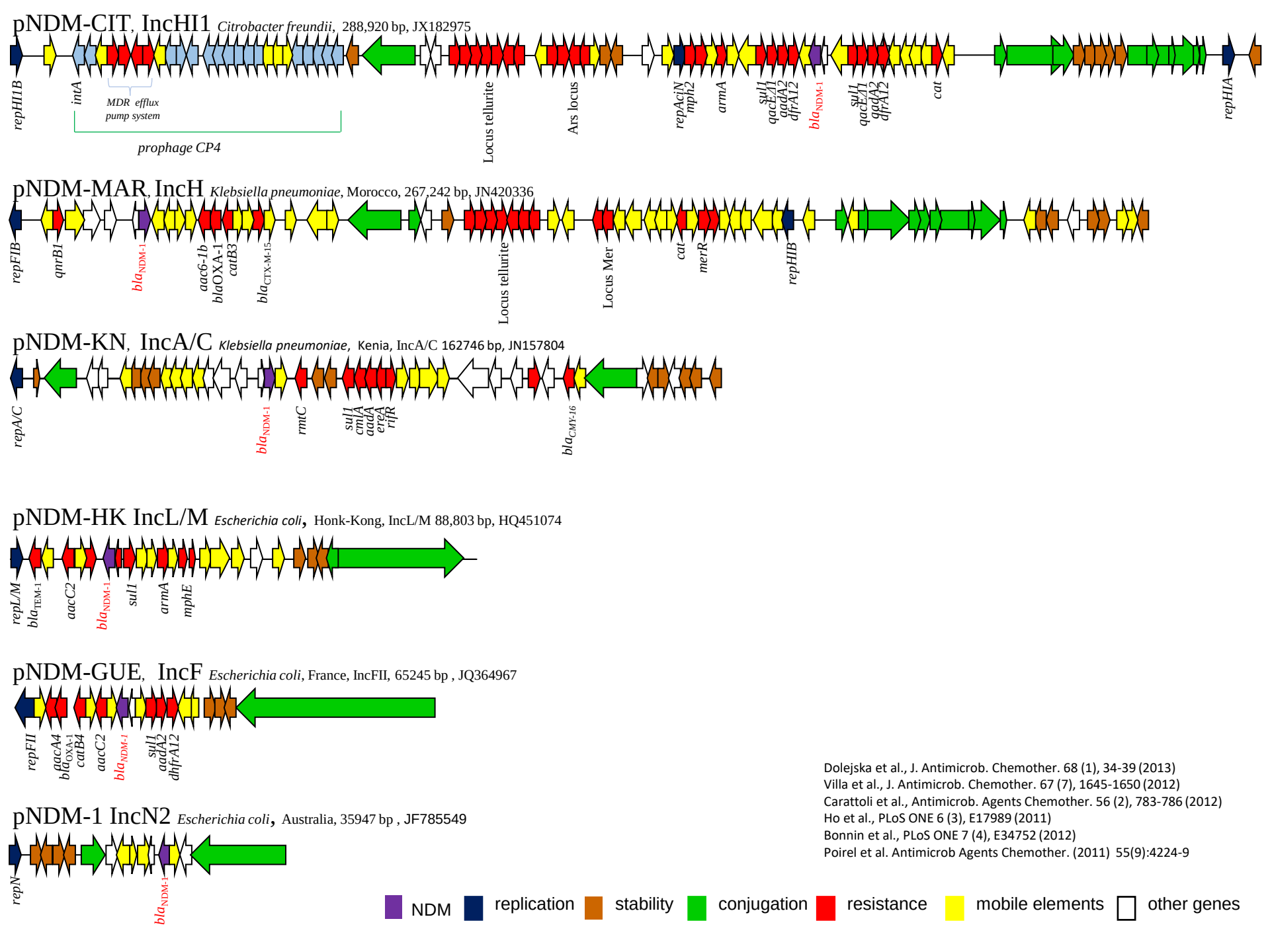
pKBN10P04869C
CP026476, South Korea

pOXA-181-IHIT35346
KX894452, Germany

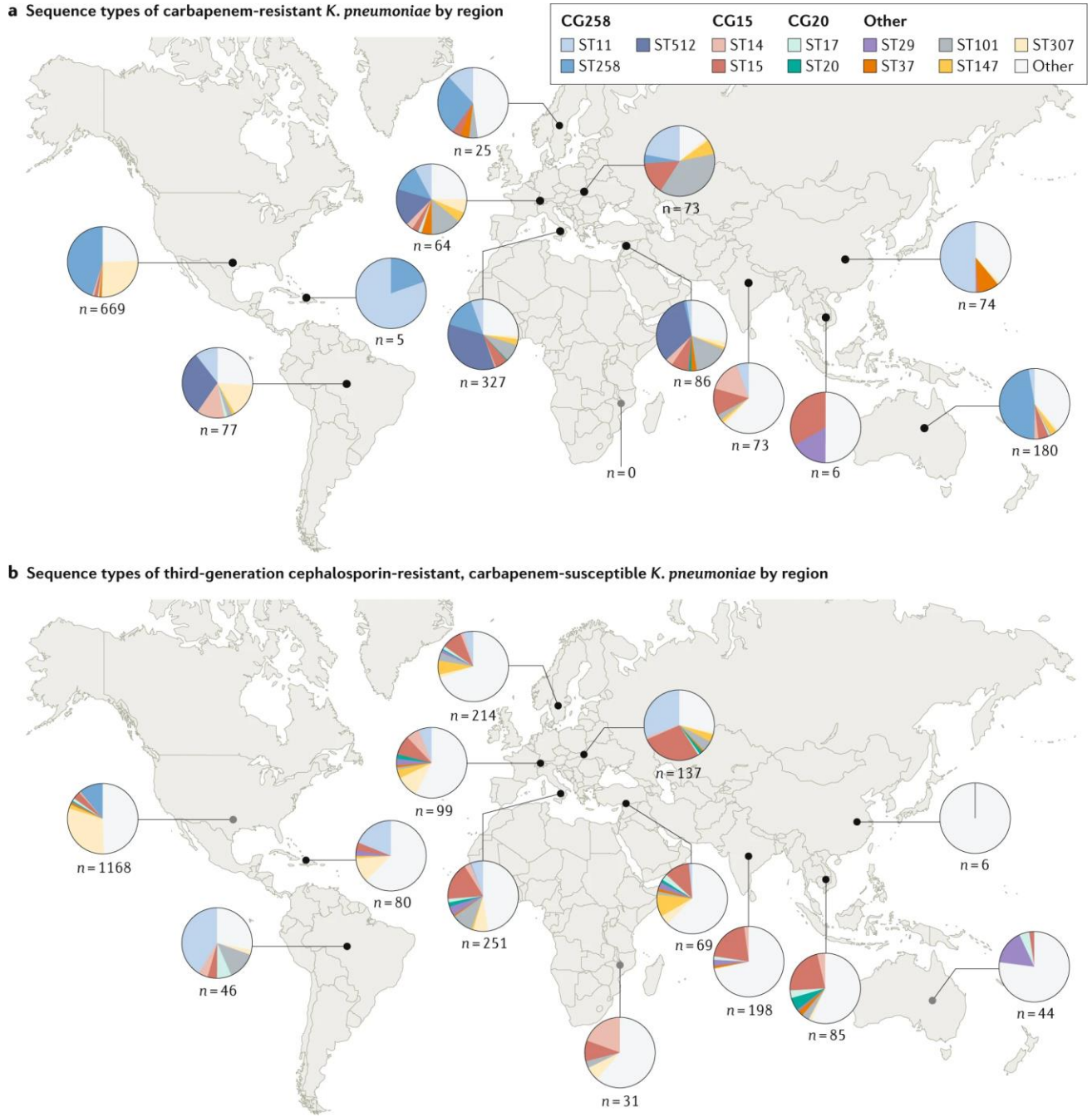
pKP_BO_OXA-181
MG228426, Italy

IncX3_OXA_181
MG570092, Lebanon





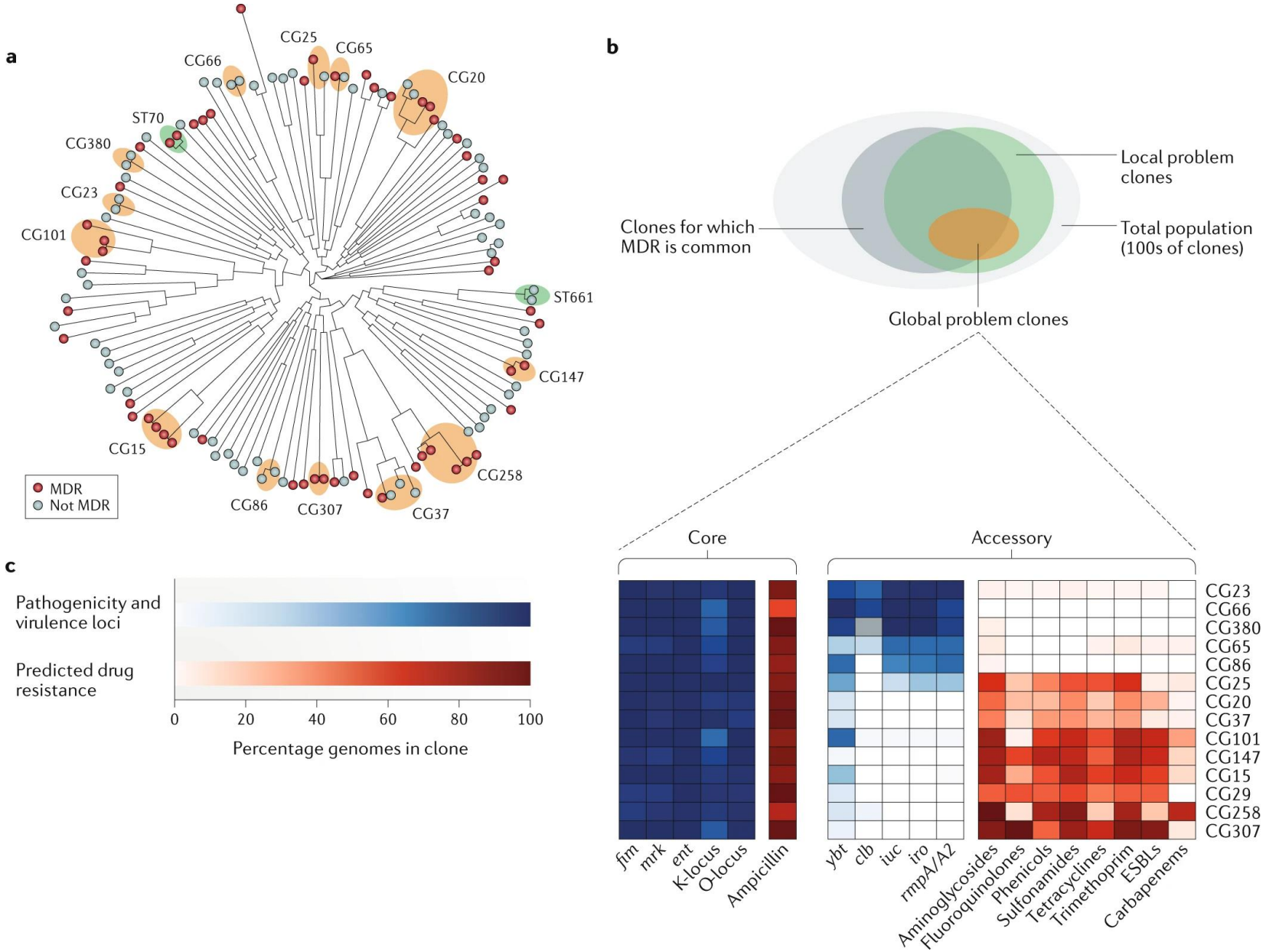
Dolejska et al., J. Antimicrob. Chemother. 68 (1), 34-39 (2013)
Villa et al., J. Antimicrob. Chemother. 67 (7), 1645-1650 (2012)
Carattoli et al., Antimicrob. Agents Chemother. 56 (2), 783-786 (2012)
Ho et al., PLoS ONE 6 (3), E17989 (2011)
Bonnin et al., PLoS ONE 7 (4), E34752 (2012)
Poirel et al. Antimicrob Agents Chemother. (2011) 55(9):4224-9



Cloni ad alto rischio

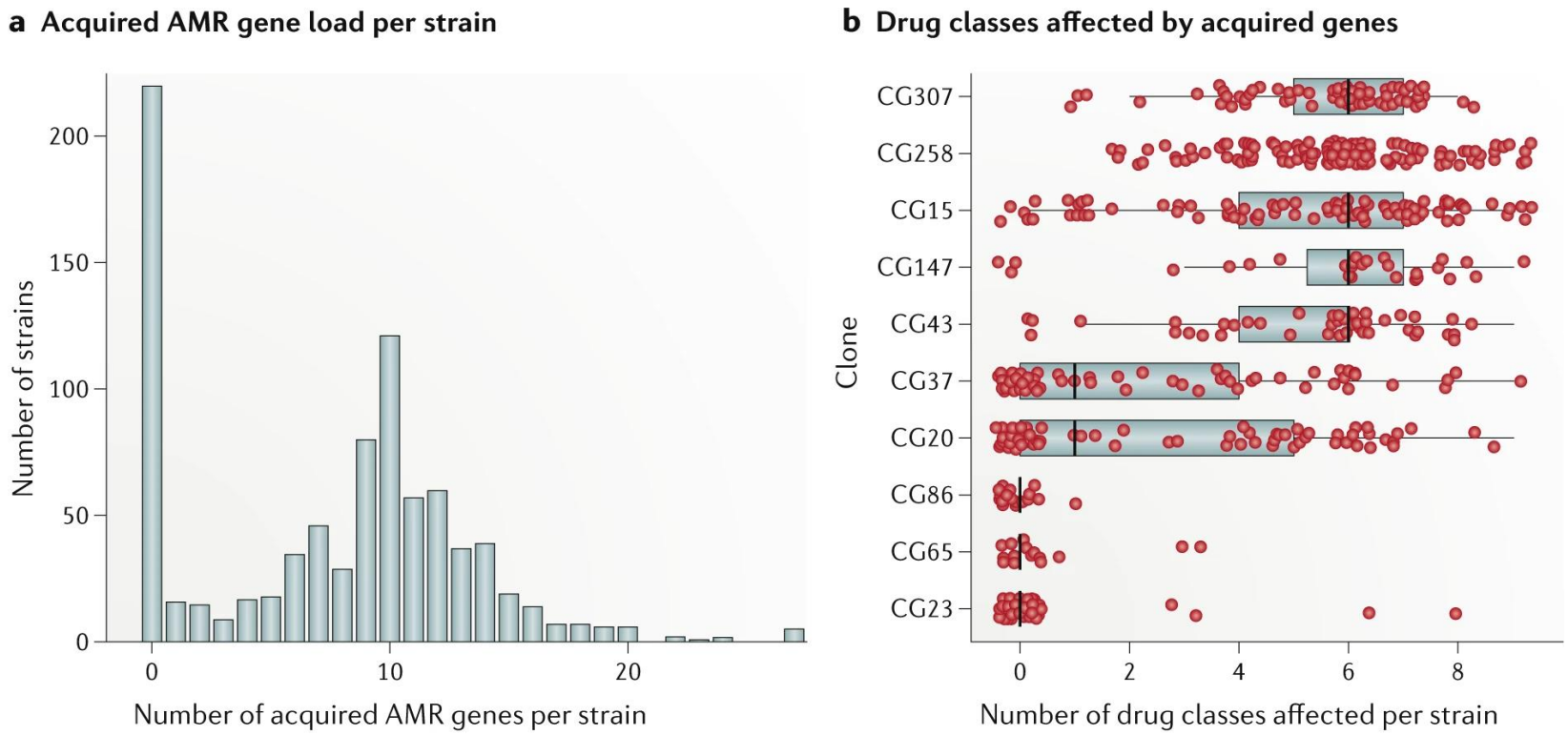
Wyres, K.L., Lam, M.M.C. & Holt, K.E. Population genomics of *Klebsiella pneumoniae*. *Nat Rev Microbiol* 18, 344–359 (2020)

Klebsiella pneumoniae High-Risk Clones



Wyres, K.L., Lam, M.M.C. & Holt, K.E. Population genomics of *Klebsiella pneumoniae*. *Nat Rev Microbiol* 18, 344–359 (2020)

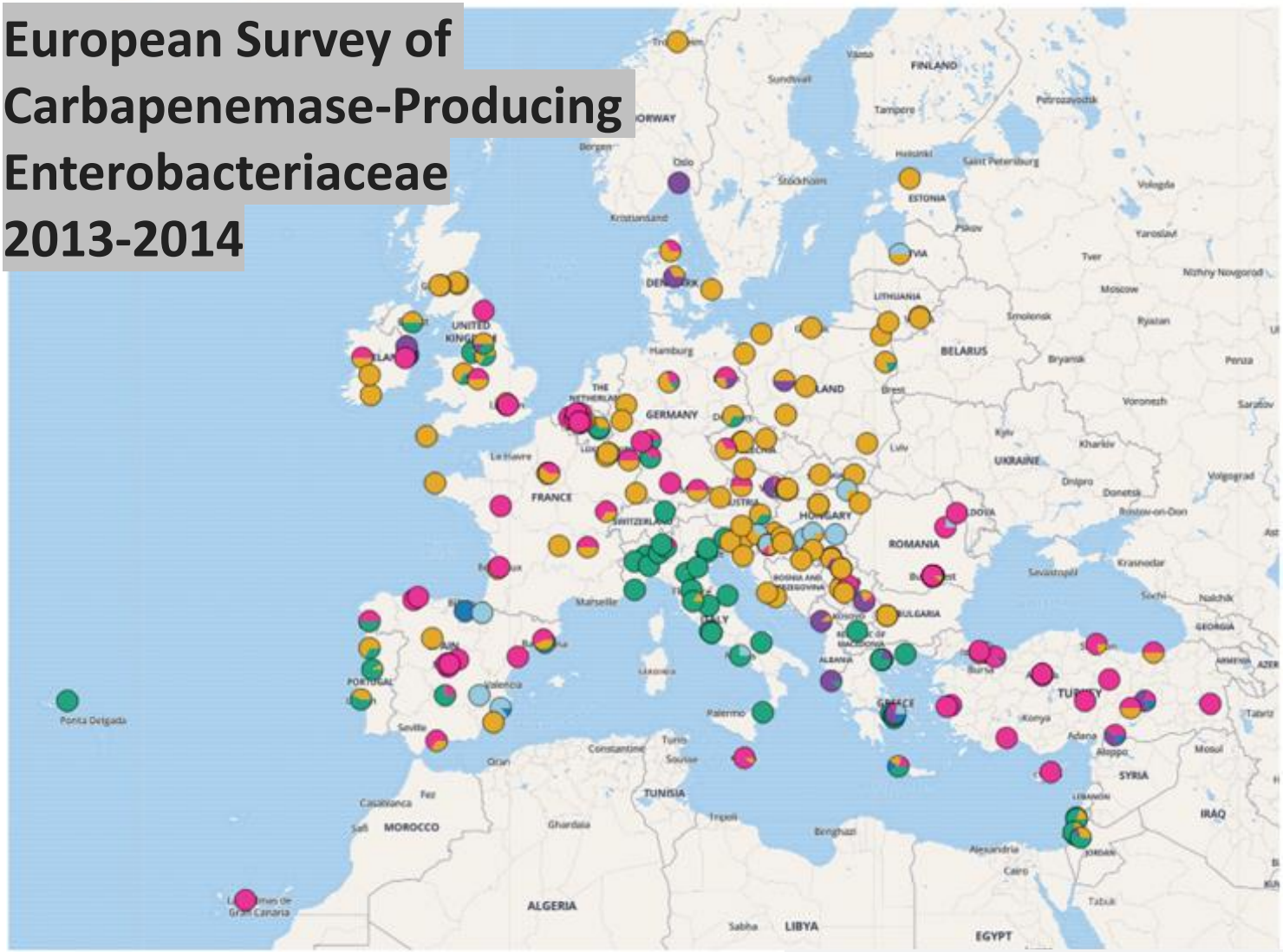
Acquisizione di geni di resistenza in *Klebsiella pneumoniae*



Wyres, K.L., Lam, M.M.C. & Holt, K.E. Population genomics of *Klebsiella pneumoniae*. *Nat Rev Microbiol* 18, 344–359 (2020)

Passaggio di plasmidi tra due cloni di *Klebsiella pneumoniae*

European Survey of Carbapenemase-Producing Enterobacteriaceae 2013-2014

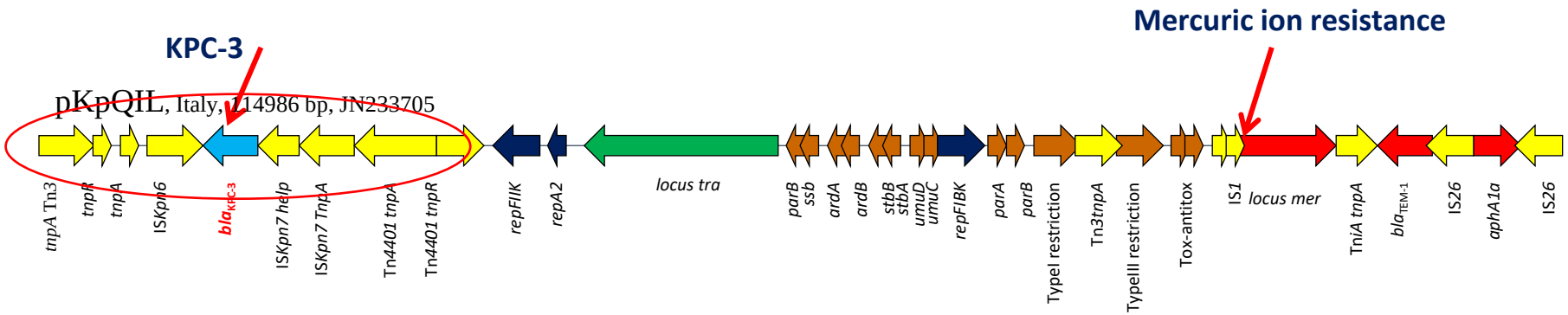


Epidemic of carbapenem-resistant *Klebsiella pneumoniae* in Europe is driven by nosocomial spread

Nat Microbiol. 2019 4:1919-1929

Sophia David[1], Sandra Reuter[2], Simon R Harris[3], Corinna Glasner[4], Theresa Feltwell[3], Silvia Argimon[1], Khalil Abudahab[1], Richard Goater[1], Tommaso Giani[5], Giulia Errico[6], Marianne Aspbury[7], Sara Sjunnebo[8], EuSCAPE Working Group; ESGEM Study Group; Edward J Feil[9], Gian Maria Rossolini[5,10], David M Aanensen[11,12], Hajo Grundmann[13,14]

CC258 *K. pneumoniae KPC-3* plasmid



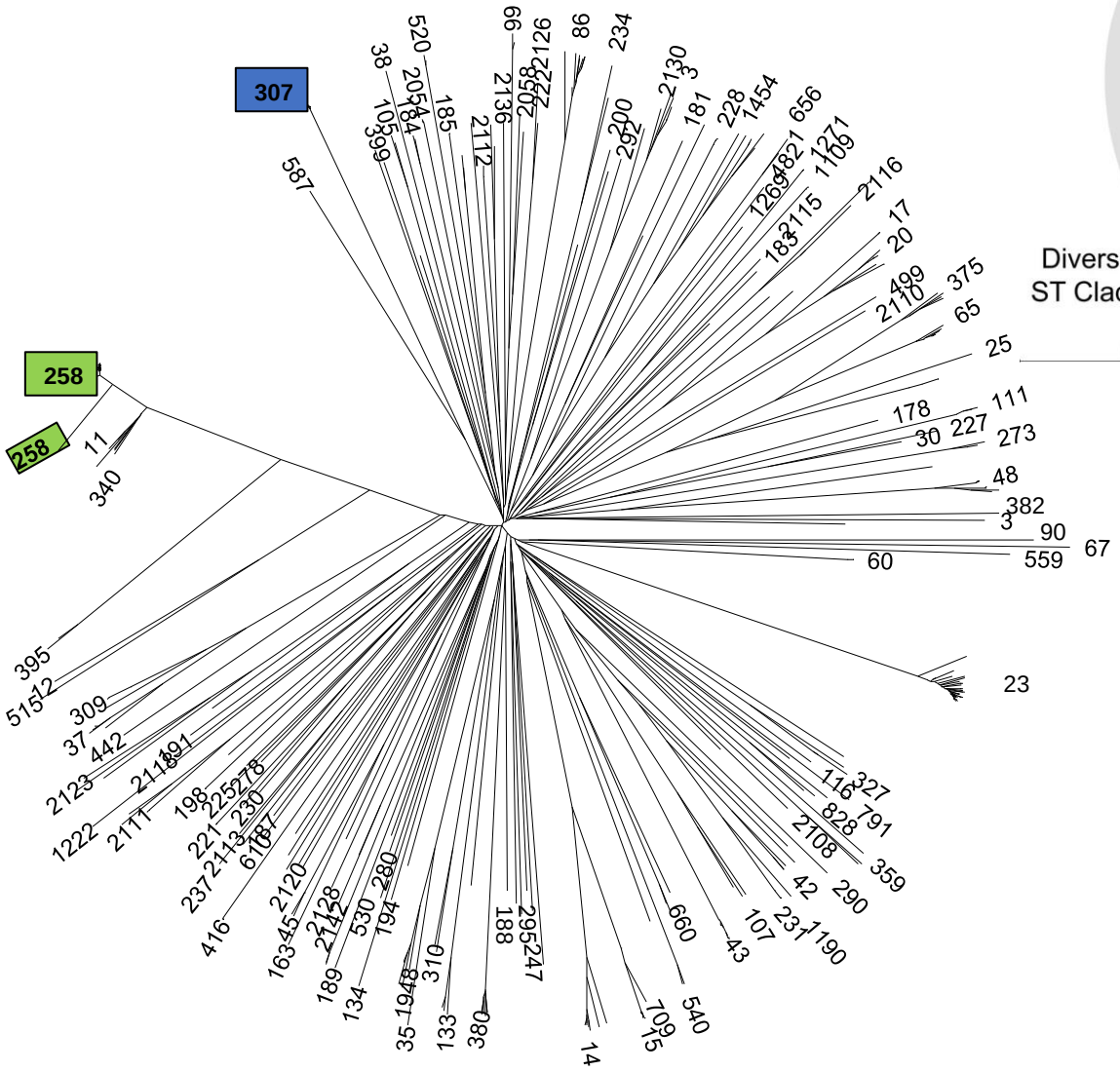
García-Fernández *et al.*, Antimicrob Agents Chemother. 2012 ; 56:2143-5

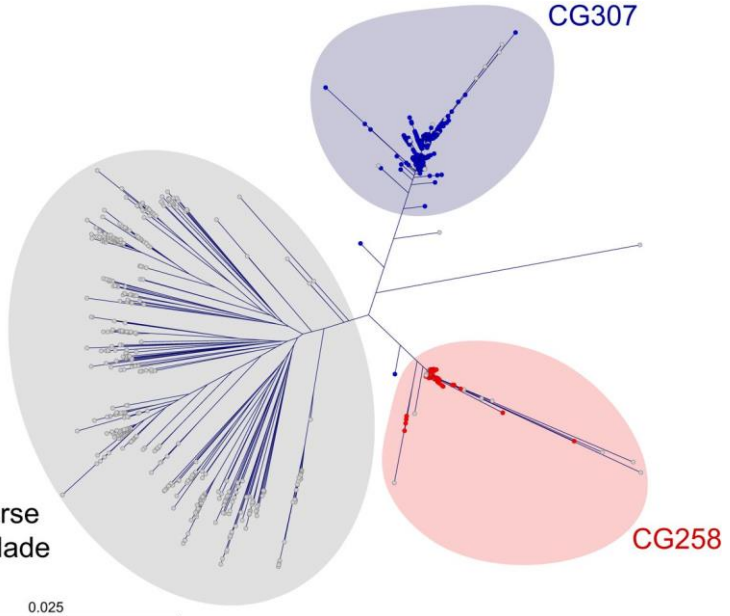
carbapenemase replication stability conjugation resistance mobile elements other genes

Diversity, virulence, and antimicrobial resistance of the KPC-producing *Klebsiella pneumoniae* ST307 clone

Villa L, C Feudi, D Fortini, S Brisse, V Passet, C Bonura, A Endimiani, C Mammina, AM Ocampo, JN Jimenez, Ml Doumith, N Woodford, K Hopkins and A Carattoli

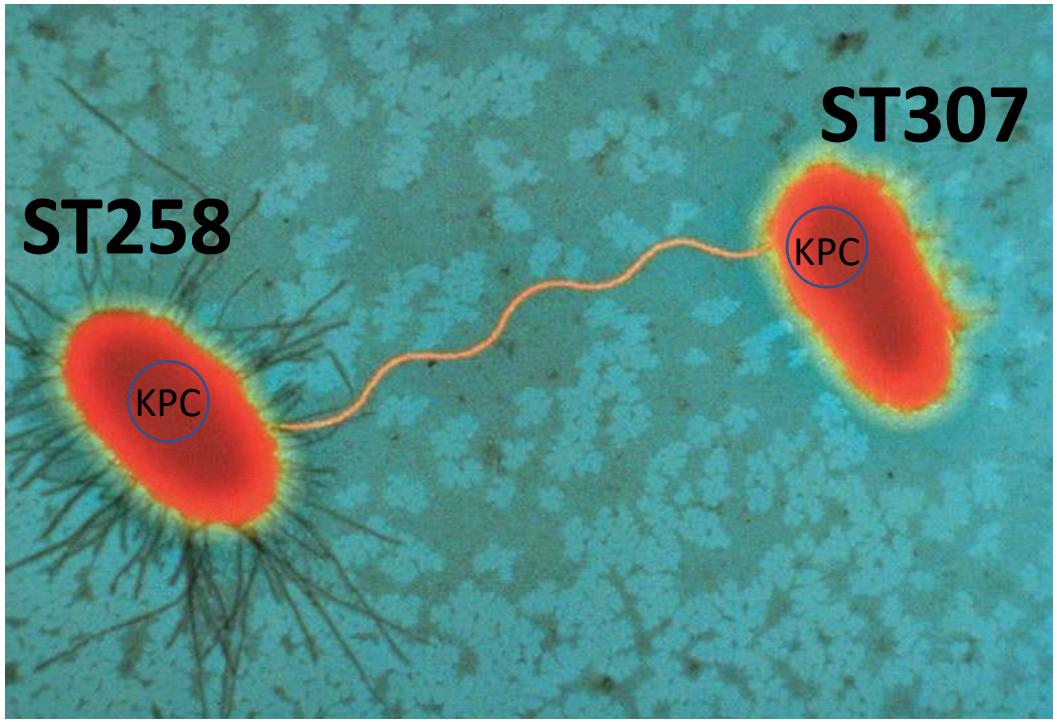
Microbial Genomics, 2017 3





Population Genomic Analysis of 1,777 Extended-Spectrum Beta-Lactamase-Producing *Klebsiella pneumoniae* Isolates, Houston, Texas: Unexpected Abundance of Clonal Group 307. Long SW, Olsen RJ, Eagar TN, Beres SB, Zhao P, Davis JJ, Brettin T, Xia F, Musser JM. MBio. 2017 8

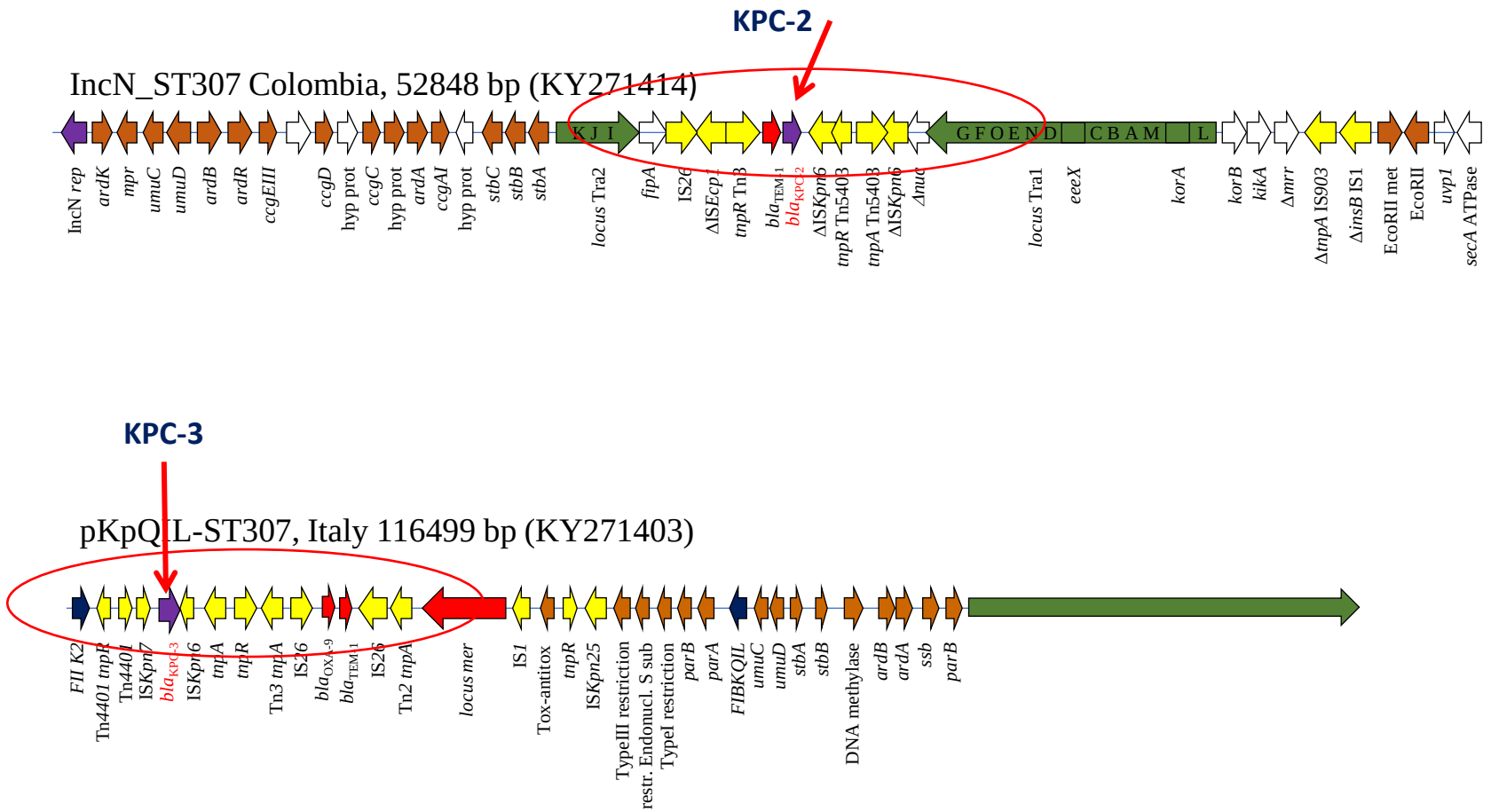
Emergence of ST307



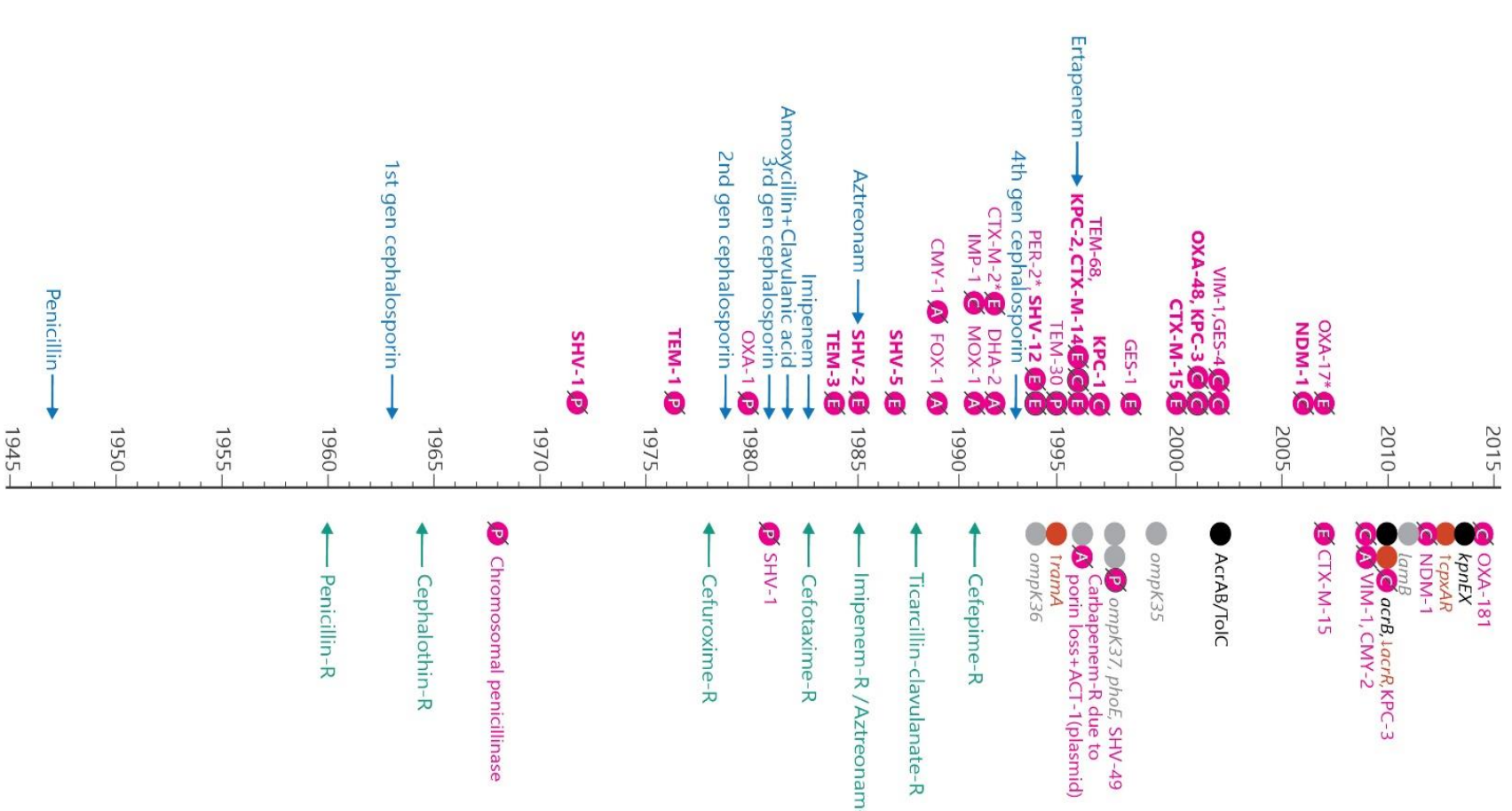
Trasmissione orizzontale del plasmide KPC

CG258 (47.4%), CG307 (19.9%), ST101 (15.4%) and ST395 (5.1%)

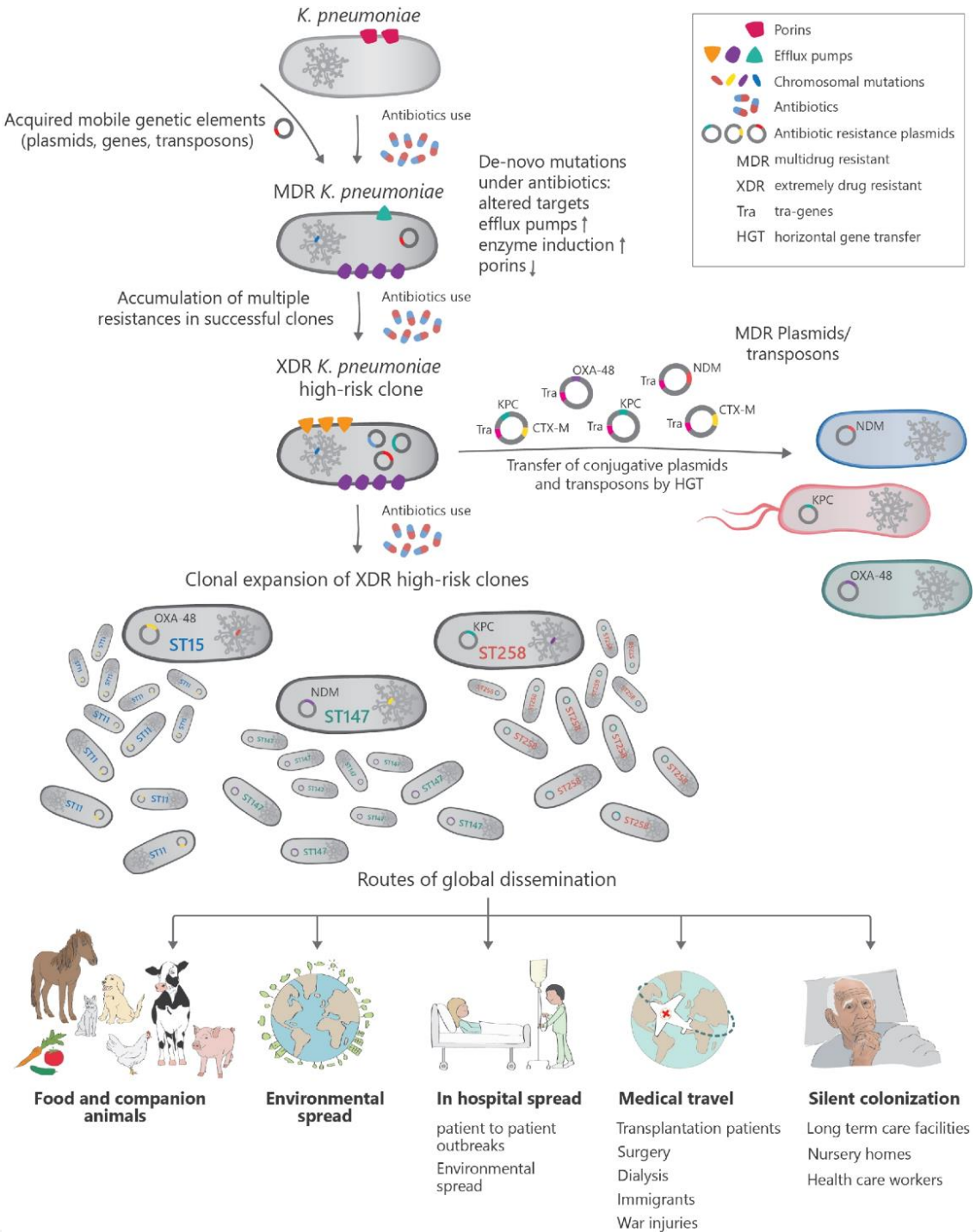
The changing epidemiology of carbapenemase-producing *Klebsiella pneumoniae* in Italy: toward polyclonal evolution with emergence of high-risk lineages.
Di Pilato V et al., JAC 202176:355-361


KPC-2
IncN_ST307 Colombia, 52848 bp (KY271414)
KJI
GFOENDCBAML
IncN rep
ardK
mpr
umuC
umuD
ardB
ardR
ccgEIII
ccgD
hyp prot
ccgC
hyp prot
ardA
ccgAI
hyp prot
stbC
stbB
stbA
locus Tra2
fipA
IS26
ΔISEcp1
tnpR Tn3
blaTEM1
blaKPC2
ΔISKpn6
tnpR Tn5403
tnpA Tn5403
ΔISKpn6
Δnuc
locus Tra1
eeeX
korA
korB
kikA
Δmrr
ΔtnpA IS903
ΔinsB IS1
EcoRII met
EcoRII
uvp1
secA ATPase
KPC-3
pKpQIL-ST307, Italy 116499 bp (KY271403)
FII K2
Tn4401 tnpR
Tn4401
ISKpn7
blaKPC-3
ISKpn6
tnpA
tnpR
Tn3 tnpA
IS26
blaOXA-9
blaTEM1
IS26
Tn2 tnpA
locus mer
IS1
Tox-antitox
tnpR
ISKpn25
TypeIII restriction
restr. Endonucl. S sub
TypeI restriction
parB
parA
FIBKQIL
umuC
umuD
stbA
stbB
DNA methylase
ardB
ardA
ssb
parB
carbapenemase
replication
stability
conjugation
resistance
Mobile elements
virulence

Time-line describing the evolvement of *K. pneumoniae* resistome



From: *Klebsiella pneumoniae*: a major worldwide source and shuttle for antibiotic resistance
Shiri Navon-Venezia, Kira Kondratyeva, Alessandra Carattoli
FEMS Microbiol Rev. 2017;41(3):252-275.



Klebsiella pneumoniae: a major worldwide source and shuttle for antibiotic resistance
Shiri Navon-Venezia,
Kira Kondratyeva, Alessandra Carattoli
FEMS Microbiol Review 2017;41(3):252-275.