

Supplementary Information

for

Aqueous phase synthesis of copper nanoparticles: A link between heavy metal resistance and nanoparticle synthesis ability in bacterial systems

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SilA <i>Morganella morganii</i>	MIEWIIRRSVANRFLVMMGALFLSIWGTWTIINTPVDALPDLSDVQVIK	50
CusA <i>Escherichia coli</i>	MIEWIIRRSVANRFLVLMGALFLSIWGTWTIINTPVDALPDLSDVQVIK	50
	*****;*****	
SilA <i>Morganella morganii</i>	TSYPGQAPQIVENQVTYPLTTTMLSVPGAKTVRGFSQFGDSYVYVIFEDG	100
CusA <i>Escherichia coli</i>	TSYPGQAPQIVENQVTYPLTTTMLSVPGAKTVRGFSQFGDSYVYVIFEDG	100

SilA <i>Morganella morganii</i>	TDLYWARSRVLEYLNQVQGKLPAGVSSEIGPDATGVGWIFEYALVDRSGK	150
CusA <i>Escherichia coli</i>	TDPLYWARSRVLEYLNQVQGKLPAGVSAELGPDATGVGWIYEYALVDRSGK	150
	** *****;*****;*****	
SilA <i>Morganella morganii</i>	HDLSSELRLQDWFLKPELKTIPNVAEVASVGGVVKQYQIQVNPVKLSQYG	200
CusA <i>Escherichia coli</i>	HDLADLRSLQDWFLKYELKTIPDVAEVASVGGVVKYQVVIDPQRLAQYG	200
	;**;*****;*****;***;*:***;***	
SilA <i>Morganella morganii</i>	ISLPEVKQALESSNQEAGGSSVEMAEYMVRASGYLQSIDDFNNIVLKT	250
CusA <i>Escherichia coli</i>	ISLAEVKSA LDASNQEAGGSSIELAEYMVRASGYLQTLDDFNHIVLKA	250
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SilA <i>Morganella morganii</i>	GENGVPVYLRDVARVQTGPEMRR-----	273
CusA <i>Escherichia coli</i>	SENGVPVYLRDVAKVQIGPEMRRGIAELNGEGEVAG	286
	_*****;** *****	

Figure S1. Comparison of amino acid sequence of SilA from *M. morganii* to that of CusA from *E. coli*.

SilB <i>Morganella morganii</i>	MASLKIKYAAIISSLIAGGLISVTAWQYLNSSQKTQTEQKAPEKKVLF	50
CusB <i>Escherichia coli</i>	MASLKIKYAAIISSLIAGGLISVTAWQYLNSSQKTQTEQKAPEKKVLF	50

SilB <i>Morganella morganii</i>	WYDPMKPDTKFDKPGKSPFMDMDLVPKYADESGDKSSGGIRIDPTQVQNL	100
CusB <i>Escherichia coli</i>	WYDPMKPDTKFDKPGKSPFMDMDLVPKYADESGDKSSGGIRIDPTQVQNL	100

SilB <i>Morganella morganii</i>	GLKTQKVTRGMLNYSQTIPANVSYNEYQFVIVQARSDGFVEKVYPLTIGD	150
CusB <i>Escherichia coli</i>	GLKTQKVTRGMLNYSQTIPANVSYNEYQFVIVQARSDGFVEKVYPLTIGD	150

SilB <i>Morganella morganii</i>	HVKKGTPOLIDITIPWVEAQSEFLLSGTGGETPQIKGVLERLRLAGMPE	200
CusB <i>Escherichia coli</i>	HVKKGTPOLIDITIPWVEAQSEFLLSGTGGETPQIKGVLERLRLAGMPE	200

SilB <i>Morganella morganii</i>	EDIQRLRSTRTIQTRFTIKAPIDGVITAFDLRTGMNISKDKVVAQIQGMD	250
CusB <i>Escherichia coli</i>	EDIQRLRSTRTIQTRFTIKAPIDGVITAFDLRTGMNISKDKVVAQIQGMD	250

SilB <i>Morganella morganii</i>	PVWISAAPVESIAYLLKDTSQFEISVPAYPDKTFHVEKWNILPSVDQTTR	300
CusB <i>Escherichia coli</i>	PVWISAAPVESIAYLLKDTSQFEISVPAYPDKTFHVEKWNILPSVDQTTR	300

SilB <i>Morganella morganii</i>	TLQVRLQVSNKDEFLKPGMNAYLKLNTQSQEMLLIPSQAVIDTGKEQRVI	350
CusB <i>Escherichia coli</i>	TLQVRLQVSNKDEFLKPGMNAYLKLNTQSQEMLLIPSQAVIDTGKEQRVI	350

SilB <i>Morganella morganii</i>	TVDDEGKFVPKQIHVLHESQQQSGIGSGLNEGDTVVVSGFLIDSEANIT	400
CusB <i>Escherichia coli</i>	TVDDEGKFVPKQIHVLHESQQQSGIGSGLNEGDTVVVSGFLIDSEANIT	400

SilB <i>Morganella morganii</i>	GALERMRHPEKTENSMAMPAMSEQPVNMHSGH	430
CusB <i>Escherichia coli</i>	GALERMRHPEKTENSMAMPAMSEQPVNMHSGH	430

Figure S2. Comparison of amino acid sequence of SilB from *M. morganii* to that of CusB from *E. coli*.

SilC <i>Morganella morganii</i>	MPKLLKLLSISTIFILAGCVSLAPFYQRPAPVPQQFSLSRNSLTPAVNGY	50
CusC <i>Escherichia coli</i>	MPKLLKLLSISTIFILAGCVSLAPFYQRPAPVPQQFSLSRNSLTPAVNGY	50

SilC <i>Morganella morganii</i>	QDTGWRNFFVDPQVTRLITEALTNNRDLRMAALKVEEARAQFNVTADADRY	100
CusC <i>Escherichia coli</i>	QDTGWRNFFVDPQVTRLITEALTNNRDLRMAALKVEEARAQFNVTADADRY	100

SilC <i>Morganella morganii</i>	PQLNASSGITYSGGLKGDKPTTQEYDAGLEFSYELDFFGKLNMSDADRQ	150
CusC <i>Escherichia coli</i>	PQLNASSGITYSGGLKGDKPTTQEYDAGLEFSYELDFFGKLNMSDADRQ	150

SilC <i>Morganella morganii</i>	NYFASEEARRAVRILLVSNVSQSYFSQQLAYEQLRIARETLKNYQQSYAF	200
CusC <i>Escherichia coli</i>	NYFASEEARRAVHILLVSSVSQSYFSQQLAYEQLRIARETLKNYQQSYAF	200

SilC <i>Morganella morganii</i>	VEQQLVGTSTNVLALBQARGQIESTRAEIAKREGDLAHANNALQLVLGTY	250
CusC <i>Escherichia coli</i>	VEQQLVGTSTNVLALBQARGQIESTRAEIAKREGDLAKANNALQLVLGTY	250

SilC <i>Morganella morganii</i>	RALPSEKGM-----	259
CusC <i>Escherichia coli</i>	RALPSEKGMKGGBIAPVKLPPLSSQILQRPDIMEABYQLKAADANIGA	300

SilC <i>Morganella morganii</i>	-----	
CusC <i>Escherichia coli</i>	ARAAFFPSITLTSGLSASSTELSSLFTSGSGMWNFIPKIEIPFNAGRNK	350
SilC <i>Morganella morganii</i>	-----	
CusC <i>Escherichia coli</i>	ANLKLAEIRQQQS VVNYESQKIQSAFKDVSDTLALRLDLSLQQLESQQRYLD	400
SilC <i>Morganella morganii</i>	-----	
CusC <i>Escherichia coli</i>	SLQITLQRARGLYASGAVSYIEVLDAERSLPATQQTILDLTYSRQVNEIN	450
SilC <i>Morganella morganii</i>	-----	
CusC <i>Escherichia coli</i>	LPTALGGGWVE	461

Figure S3. Comparison of amino acid sequence of SilC from *M. morganii* to that of CusC from *E. coli*.

SilP <i>Morganella morganii</i>	MKNDNAVQHNNQTASEQTLSPDEGHVLRKVRDPVCGMAILPDRAHSSIRY	50
P-type ATPases <i>Escherichia coli</i>	MKNDNAVQHNNQTASEQTLSPDEGHVLRKVRDPVCGMAILPDRAHSSIRY	50
	*****;*****	
SilP <i>Morganella morganii</i>	QDHQLYFCSASCESKFKAHPDRYLTEDASEHSHHHHHHDHHEVSPDQIKQP	100
P-type ATPases <i>Escherichia coli</i>	QDHQLYFCSASCESKFKAHPDRYLTEDASEHSHHHHHHDHHEVSPDQIKQP	100

SilP <i>Morganella morganii</i>	HHQAEKENSEGVWTCPMHPEIRRSGPSVCGMALEPLVATASTGPSDE	150
P-type ATPases <i>Escherichia coli</i>	HHQAEKENSEGVWTCPMHPEIRRSGPSVCGMALEPLVATASTGPSDE	150

SilP <i>Morganella morganii</i>	LHDMTRRFWLGLLLAFPVLVLEMGSHLFPELRNTVPPQYNTWLQLLLASP	200
P-type ATPases <i>Escherichia coli</i>	LHDMTRRFWLGLLLAFPVLVLEMGSHLFPELRNTVPPQYNTWLQLLLASP	200
	*****;*****	
SilP <i>Morganella morganii</i>	VVLWCGWPFFARAGMSLRNRSLSNMFTP-----	227
P-type ATPases <i>Escherichia coli</i>	VVLWCGWPFFARAGMSLRNRSLSNMFTLVAMGTGVAVVYSVIATVFPSSWFP	250

SilP <i>Morganella morganii</i>	-----	
P-type ATPases <i>Escherichia coli</i>	ASFRNMDGLVAVYFEAAAVITVLVLLGQVLELRAREQTSGAITALLNLAP	300

Figure S4. Comparison of amino acid sequence of SilP from *M. morganii* to that of P-type ATPases from *E. coli*.

SiIR <i>Morganella morganii</i>	MKILIVEDEIKTGEYLSKGLTEAGFVVDHADNGLTGHYLAMTA EYDLVIL	50
CusR <i>Escherichia coli</i>	MKLLIVEDEKKTGEYLTGKLT EAGFVVDLADNGLNGYHLMATG DYDLIIL	50
	:*:*** *:*****:***** *****.*****.:***:**	
SiIR <i>Morganella morganii</i>	DIMLPDVNGWDIIRMLRSAGKMPVLLLTALGTIEHRVKGLELGADDYLV	100
CusR <i>Escherichia coli</i>	DIMLPDVNGWDIVRMLRSANKGPILLLTALGTIEHRVKGLELGADDYLV	100
	*****:*****.*****:*****	
SiIR <i>Morganella morganii</i>	KPF AFAELLARVRTLLRRGNTMITESQLKVADLSVDLVSRKVS RAGNRIV	150
CusR <i>Escherichia coli</i>	KPF AFAELLARVRTLLRRGA VIESQFQVADLMVDLVSRKVTRSGTRIT	150
	*****:*****:***** *****:***.***.	
SiIR <i>Morganella morganii</i>	LTSKEFSLLEFFIRHQGEVLPRSLIASQVWDM SFDSDTNAIDVAVKRLRA	200
CusR <i>Escherichia coli</i>	LTSKEFTLLEFFLRHQGEVLPRSLIASQVWDMN FSDSDTNAIDVAVKRLRG	200
	*****:*****:*****.*****.	
SiIR <i>Morganella morganii</i>	KIDNDYGTKLIQTVRGVGYMLEIPDA-	226
CusR <i>Escherichia coli</i>	KIDNDFEPKLIQTVRGVGYMLEVPDQG	227
	*****:*****:*****.	

Figure S5. Comparison of amino acid sequence of SilR from *M. morganii* to that of CusR from *E. coli*.



Figure S6. Comparison of amino acid sequence of SilS from *M. morganii* to that of CusS from *E. coli*.

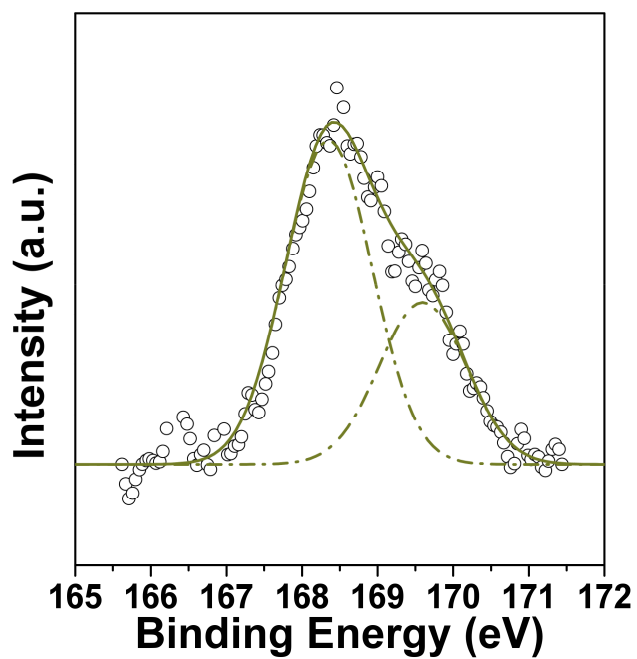


Figure S7. XPS spectra showing S 2p core level binding energy arising from CuNPs biosynthesized using *M. morganii*.