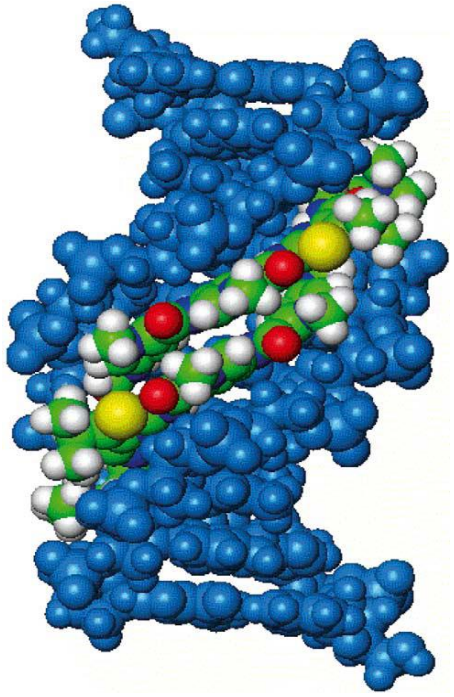
MGB Biopharma

Bringing True Novelty to the Anti-Infectives Space

New Class of Antibacterials Based on a Completely New Mechanism of Action

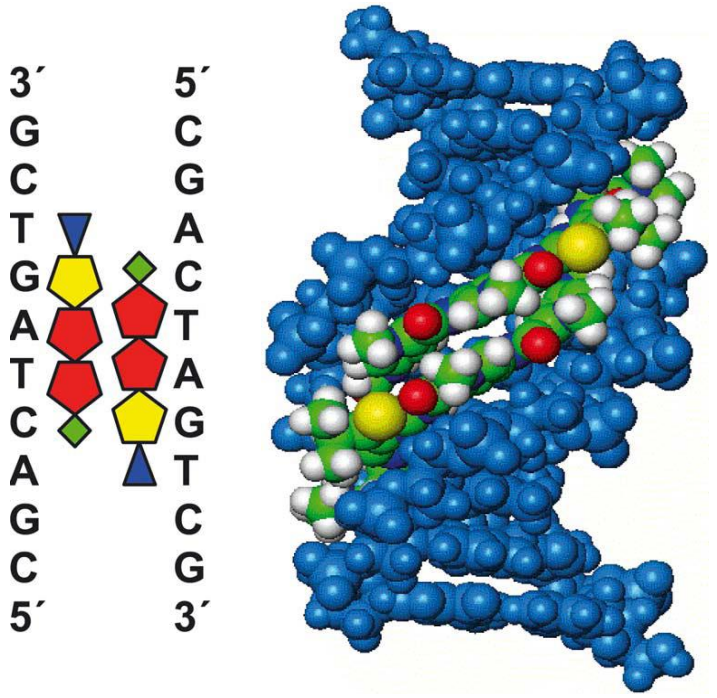


MGB Biopharma – Delivering True Novelty

- Developing a truly novel class of drugs for infectious diseases based on the University of Strathclyde's DNA Minor Groove Binder (MGB) Technology
- This platform provides an opportunity to develop various compounds against bacteria, viruses, fungi and parasites with a completely new mode of action which are distinct from the antimicrobial drugs used in clinical practice today
- MGB-BP-3 is the first compound from this platform, with strong activity against Gram-positive pathogens, ready to progress into clinical development
- Founded in April 2010 – HQ in Glasgow, Scotland - and funded by an Angel syndicate and the Scottish Co-Investment Fund

The First Novel Mode of Action For Decades

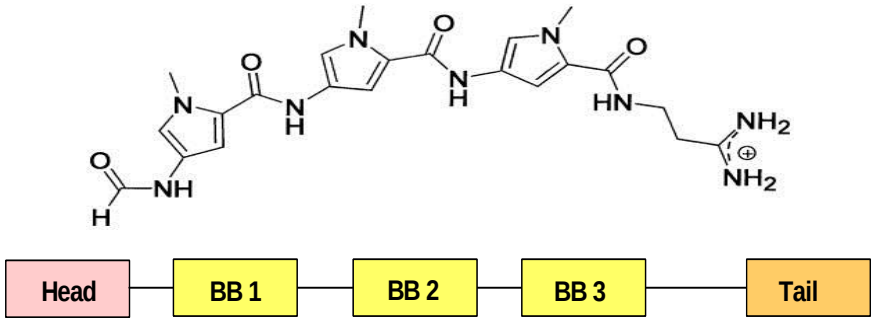
- MGBs bind A-T or G-C rich sequences within the minor groove of bacterial DNA in a sequence and conformation-specific fashion
- Interferes with transcription factors and alters the microorganism's regulation
- Does not inhibit bacterial DNA replication



Binding of MGB-BP-3 compound to the DNA minor groove; NMR-derived structure

Creating Our Novel Technology Platform

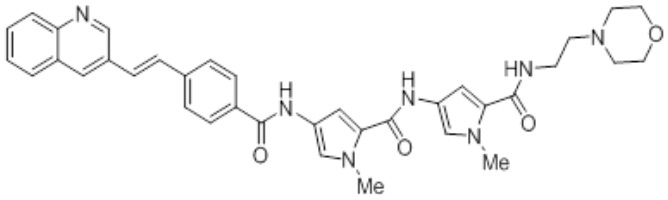
The basic structure of the MGB chemical platform is based on distamycin A



Distamycin A

- Changing the type, position and links of the building blocks and by introducing different head and tail components and side radicals, enables specific activity against different microorganisms
- Principal components of IP:
  - new building blocks - in particular a thiazole
  - short, branched alkyl chains as part of the thiazole
  - alkenes as links between the building blocks

MGB-BP-3 – Our Lead Molecule



- Oral formulation for C. *difficile* infections – endorsed by MHRA to progress into a phase I study
- I.V. formulation targeting a broad range of Gram +ve pathogens - clinic-ready in 2014
- Topical formulation – feasibility testing

Broad Gram +ve antimicrobial activity *in vitro*

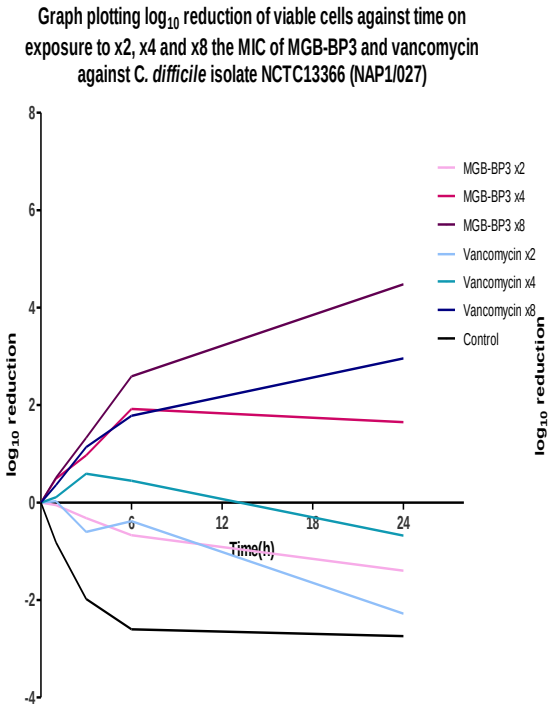
Potent antibacterial activity against all the Gram-positive bacteria tested

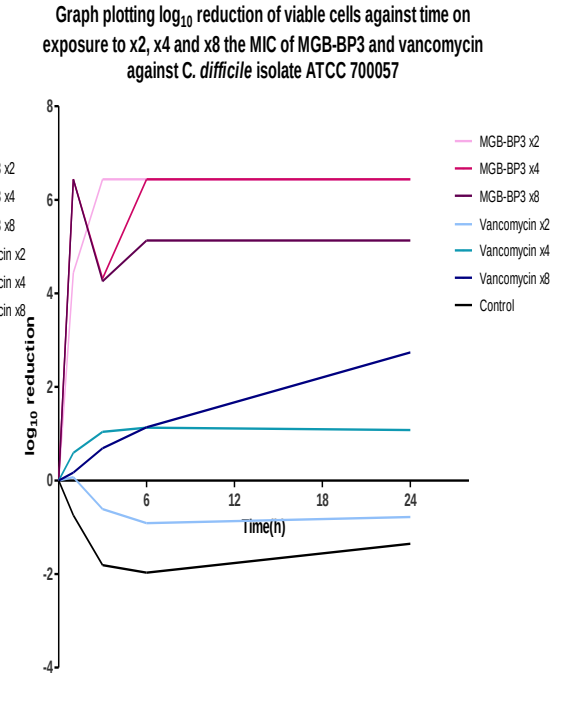
Activity against Gram-positive bacteria superior to vancomycin

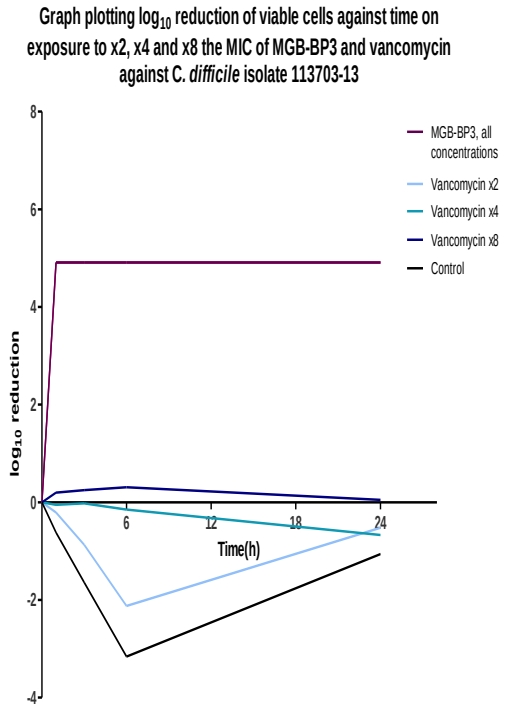
Organism		MGB-BP-3				Vancomycin			
	n=	MIC50 (mg/L)	MIC90 (mg/L)	MBC50 (mg/L)	MBC90 (mg/L)	MIC50 (mg/L)	MIC90 (mg/L)	MBC50 (mg/L)	MBC90 (mg/L)
Group B Streptococci	15	0.25	1	0.25	1	0.5	2	0.5	2
Group C Streptococci	15	0.25	1	0.5	1	0.5	1	0.5	1
Group G Streptococci	15	0.5	0.5	0.5	0.5	0.5	1	0.5	1
Methicillin-resistant *Staphylococcus aureus*	15	1	2	1	2	1	1	1	2
Methicillin-resistant *Staphylococcus epidermidis*	15	0.25	0.5	0.5	2	2	4	2	4
Methicillin-susceptible *Staphylococcus aureus*	15	0.5	1	1	2	1	2	1	2
Methicillin-susceptible *Staphylococcus epidermidis*	15	0.25	0.5	0.25	2	2	2	2	2
S. constellatus	15	0.25	0.5	0.5	1	1	1	1	2
S. mitis	15	0.5	2	0.5	2	0.5	1	0.5	1
Streptococcus pyogenes	15	0.25	0.5	0.25	2	0.5	0.5	0.5	0.5
Vancomycin-resistant *Enterococcus faecalis*	15	2	2	>32	>32	>32	>32	>32	>32
Vancomycin-resistant *Enterococcus faecium*	15	1	2	>32	>32	>32	>32	>32	>32
Vancomycin-susceptible *Enterococcus faecalis*	15	1	2	>32	>32	1	2	16	>32
Vancomycin-susceptible *Enterococcus faecium*	15	1	2	>32	>32	1	2	32	>32

MGB-BP3 is superior to vancomycin against *C. difficile* in *in vitro* tests

MGB-BP-3 was found to be superior to vancomycin against 3 *Clostridium difficile* strains, including the most virulent strain, NAP1/027.

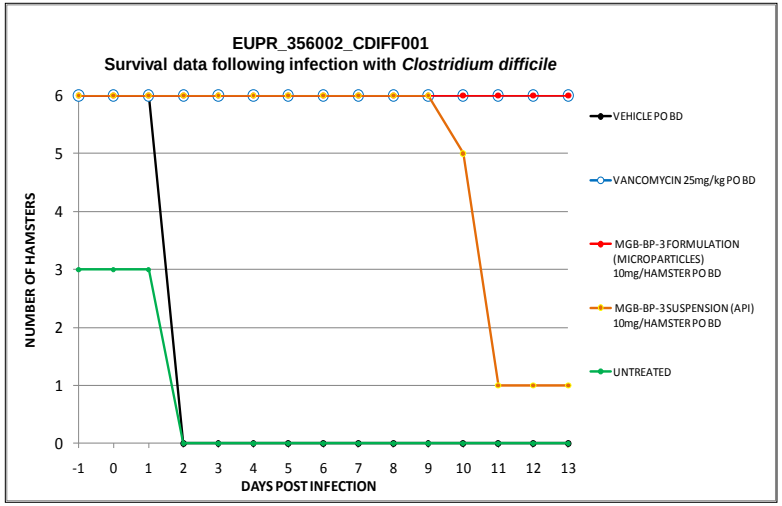


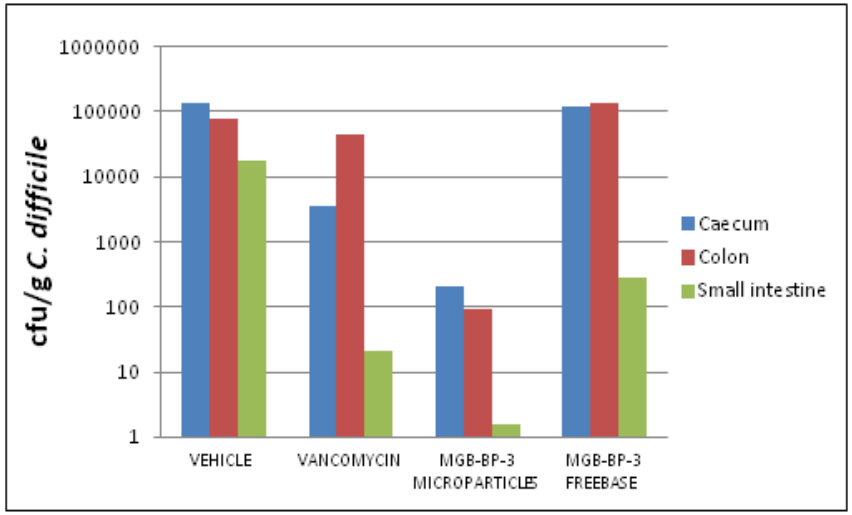




MGB-BP3 is superior to vancomycin against *C. difficile* in an animal model of infection

MGB-BP-3 was found to be at least as effective at improving survival as oral vancomycin, and its microparticle formulation was superior at reducing the recovery of *C. difficile* from the small intestine, caecum and colon in a hamster CDAD infection model.





Global Gram +ve Pipeline – Lacks Novelty

Class	Drug
Fluoroquinolones	delafloxacin
	nemonoxacin
	JNJ-Q2
Oxazolidinones	tedizolid
	radezolid
Ketolides	cethromycin
	solithromycin
Lipoglycopeptides	dalbavancin
	oritavancin
Pleuromultins	BC-3781
Peptidomimetics	PMX-30063
Fab Inhibitors	AFN-1252

US GAIN Act - Designed to Reward Novelty

Generating Antibiotic Incentives Now (GAIN) Act

FDA issued a proposed rule listing pathogens that would be eligible for drug development incentives under the Generating Antibiotic Incentives Now (GAIN) Act. The pathogens are: species of *Acinetobacter, Aspergillus, Campylobacter, Candida,* ***Enterococcus*** *and Pseudomonas* as well as ***Clostridium difficile****, Enterobacteriaceae, Neisseria gonorrhoeae,* ***Neisseria meningitidis****,* ***Staphylococcus aureus****,* ***Streptococcus agalactiae****,* ***Streptococcus pneumoniae****,* ***Streptococcus pyogenes****, Vibrio cholerae,* the *Burkholderia cepacia* complex of species, the *Mycobacterium tuberculosis* complex of species and non-tuberculous *Mycobacteria* species. FDA is required to consider four factors in establishing and maintaining the list: impact on the public health due to drug-resistant organisms in humans; rate of growth of drug-resistant organisms; increase in resistance rates and morbidity and mortality.

- **7 out of the 17 "GAIN" pathogens are sensitive to MGB-BP-3**
- **GAIN will allow MGB Biopharma and its partners to generate attractive returns from its novel anti-infective platform**

MGB's Novelty could Deliver High Returns

MGB-BP-3 attractive market positioning:

Highly novel broad range anti-Gram positive agent :

- Used where existing agents (such as vancomycin, daptomycin and linezolid) are relatively ineffective due to resistance
- GAIN would allow attractive pricing of such a "life saving" agent
- Novelty would drive initial uptake in line with Antibiotic Stewardship policy - limited marketing spend
- GAIN initiative could potentially allow for a more efficient and targeted approach to clinical development – faster and lower costs
- Limited completion would enable MGB-BP-3 to gain significant market share
- A very attractive business proposition targeting a large market opportunity

Novel Anti-Infectives Platform

Discovery	Hit-to-Lead	Lead Optimisation	Preclinical	Phase I	Phase II
MGB-BP-3 *C. diff* oral					
MGB-BP-3 MRSA etc. IV					
MGB-BP-3 topical					
Gram-negative					
Anti-fungal					
Anti-viral					
Anti-parasitic					

MGB Biopharma – Delivering True Novelty

- Developing a truly novel class of drugs for infectious diseases based on the University of Strathclyde's MGB Technology
- This platform provides an opportunity to develop various compounds against bacteria, viruses, fungi and parasites with a completely new mode of action
- MGB-BP-3 is the first compound from this platform, with strong activity against Gram-positive pathogens, ready to progress into the clinical development
- Clearly meets one of the world's major public health requirements
- MGB Biopharma is on track to be the first developer of a truly novel antibacterial for more than a decade - major beneficiary of the GAIN initiative in the US