#### **ASX Announcement**



#### Recce Pharmaceuticals Opening R&D Address at World Anti-Microbial Resistance Congress 2021

**Sydney Australia, 8 November 2021:** Recce Pharmaceuticals Ltd (**ASX:RCE, FSE:R9Q**) (**Company**), the Company developing New Classes of Synthetic Anti-infectives, today announced it will be delivering the Opening R&D Address at the World Anti-Microbial Resistance (AMR) Congress 8<sup>th</sup>-9<sup>th</sup> November 2021.

Recce Chairman, Dr John Prendergast will deliver the 20-minute Opening R&D Address, highlighting the urgent need for new antibiotics to address the rapidly growing threat of AMR. Dr Prendergast's presentation *"Synthetic Anti-Infectives: Embracing New Technology",* highlighting Recce's unique Mechanisms of Action, infectious disease pipeline of new drug candidates – positioning Recce as a sign of new hope in the global fight against superbugs on the international stage.

The two-day World AMR Congress held in Washington DC is the largest AMR conference in the world with more than 1,000 attendees from over 50 countries. The congress attracts industry leaders, clinicians, healthcare payers, and medical regulators from around the world.

**Claire Murphy, Production Director, World Anti-Microbial Congress** says: "Antimicrobial resistance is an urgent public health crisis that needs global attention, now more than ever. The World AMR Congress continues to be the go-to platform for leading antibiotic developers, such as Recce Pharmaceuticals, to connect with global AMR stakeholders and further initiatives aimed at combatting antimicrobial resistance."



The presentation is provided below and will also be made available on the Company's website in due course.

This announcement has been approved for release by Recce Pharmaceuticals Board.



#### ASX: RCE, FSE: R9Q

Head Office: Level 25, 88 Phillip Street, Aurora Place, SYDNEY NSW 2000 **T** +61 (02) 9256 2571 **R&D Centre - Perth:** Suite 10, 3 Brodie Hall Drive, Technology Park, BENTLEY WA 6102 **T** +61 (8) 9362 9860 Washington Office: 1717 Pennsylvania Avenue NW, Suite 1025, WASHINGTON DC 20006 USA



ASX:RCE FSE:R9Q

#### SYNTHETIC ANTI-INFECTIVES: EMBRACING NEW TECHNOLOGY





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# A Global Threat – Antibiotic Resistance

"To State the Obvious"

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- Occurs when bacteria change to protect themselves from an antibiotic and cause these medicines to lose their effectiveness.
  - One of the biggest threats to global health and food security today.
  - Leads to longer hospital stays, higher medical costs and increased mortality.
- A growing number of infections are becoming harder to treat as the antibiotics used to treat them become less effective.
- Occurs naturally, but misuse in humans & animals is accelerating the process.
- Affects anyone, of any age, in any country.



# Antimicrobial Agents Divided into Groups based on the Mechanism of Antimicrobial Activity



Agents that inhibit cell wall synthesis

Depolarize the cell membrane

Inhibit protein synthesis



Inhibit nuclei acid synthesis



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#### Table 1.

Antimicrobial groups based on mechanism of action.

Mechanism of Action	Antimicrobial Groups		
Inhibit Cell Wall Synthesis	β-Lactams		
	Carbapenems		
	Cephalosporins		
	Monobactams		
	Penicillins		
	Glycopeptides		
Depolarize Cell Membrane	Lipopeptides		
Inhibit Protein Synthesis	Bind to 30S Ribosomal Subuni		
	Aminoglycosides		
	Tetracyclines		
	Bind to 50S Ribosomal Subuni		
	Chloramphenicol		
	Lincosamides		
	Macrolides		
	Oxazolidinones		
	Streptogramins		
Inhibit Nucleic Acid Synthesis	Quinolones		
	Fluoroquinolones		
Inhibit Metabolic Pathways	Sulfonamides		
	Trimethoprim		

#### Table 1: Examples of drugs from each of these groups

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/

# **Antibiotic Resistance Mechanisms**

#### Four main categories:



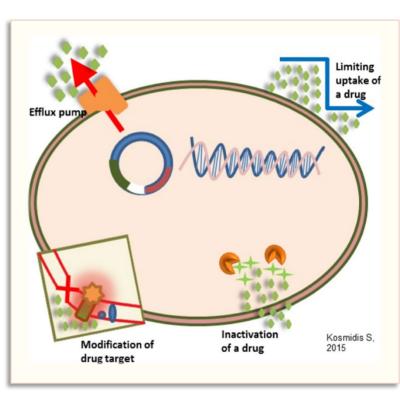


Active drug efflux

- **Intrinsic resistance** may make use of limiting uptake, drug inactivation, and drug efflux;
- Acquired resistance may make use of drug target modification, drug inactivation, and drug efflux;
- Gram-negative bacteria make use of all four main mechanisms;
- Gram-positive bacteria less commonly use limiting the uptake of a drug since they don't have an LPS outer membrane nor the capacity for certain types of drug efflux mechanisms.







https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/

# **Contributors to Antibiotic Resistance**

The emergence and spread of drug-resistant pathogens that have acquired new resistance mechanisms continues to threaten our ability to treat common infections.

#### Increased consumption of antimicrobial drugs

- Both by humans and animals; and, improper prescribing of antimicrobial therapy.

#### Overuse of many common antimicrobials agents by physicians may occur

The choice of drug is based on a combination of low cost and low toxicity.

#### Improper prescribing of antimicrobials drugs

 Initial prescription of a broad-spectrum drug that is unnecessary, or ultimately found to be ineffective for the organism(s) causing the infection.

#### Prior use of antimicrobial drugs

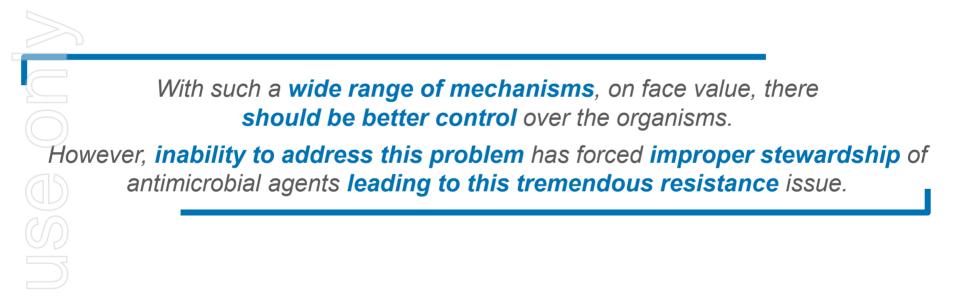
Puts a patient at risk for infection with a drug resistant organism, and those patients with the highest exposure to antimicrobials are most often those who are infected with resistant bacteria.

*Most antimicrobial compounds are naturally-produced molecules*, and, as such, co-resident bacteria have evolved mechanisms to overcome their action in order to survive.



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## **A Common Failure Associated with Existing Antibiotics**



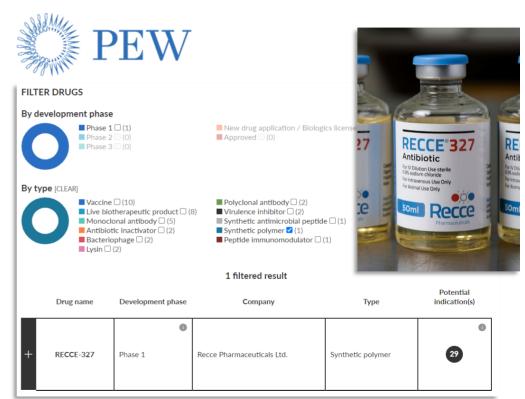


# **Natural Antibiotics vs Synthetic Antibiotics**

- **Natural Antibiotics Synthetic Antibiotics** recce.com.au
- Pre-formed natural superbugs
- All Fungi or Bacteria based
  - "Penicillin allergy is the most common drug allergy and is reported in up to 15 percent of hospitalized patients<sup>1</sup>"
- Only as good as what's found in nature
- ► Has always had naturally occurring superbugs, now multiplying out of control!
- ► **NO** pre-formed natural superbugs
- Entirely man-made and designed with purpose
- Universal MoA detailed experimentation demonstrates it does not succumb to superbugs
- Contains only what we want not reliant on what's found in nature
- Broad Spectrum capability and maintains its activity even with repeated use!

# The Pew Charitable Trusts Antibiotic Treatment List\*

- RECCE® 327 (R327) included in The Pew Charitable Trusts' annual list of "Nontraditional Products in Development to Combat Bacterial Infections Register".
- New "outside-the-box" drugs are critically needed, with conventional antibiotic pipeline extremely thin.
- As of 3/31, 36 non-traditional candidates are in clinical development ranging from vaccines to immunotherapies.
- R327 is the only synthetic polymer drug candidate for treating sepsis currently in development.



#### Image Source: The Pew Charitable Trusts 2021



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## **Recce's Anti-infective Platform:**

#### Addressing the Historic Lack of Innovation

- R327 has a **universal, multi-layered Mechanism of Action (MoA)** that **kills bacteria** and **keeps on killing with repeated use**, including multi-drug resistant superbug forms.
- Recce's anti-infectives show **no tendency for the emergence of resistance**, even after repeated use.
- Broad-spectrum capability and fast-acting MoA empowers clinicians to confidently and quickly administer the antibiotic at first patient presentation.
- When patients are rapidly deteriorating from infections, there is **no time to wait for clear diagnostics** which, despite advances in technology, remains a challenge.



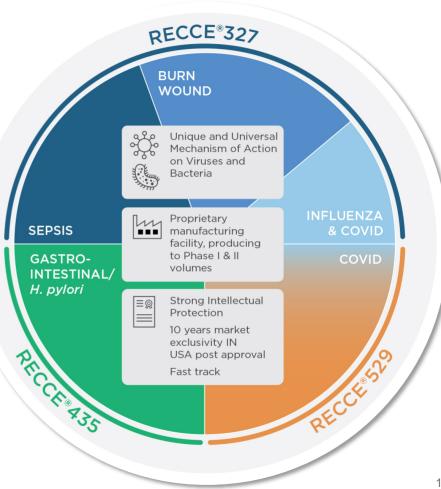
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#### **A Versatile Technology Platform**

- Anti-infective focused Biotech company targeting both bacterial and viral indications.
- Strong IP and own manufacturing capability.
- Versatile platform delivering oral, intravenous and spray formulations for a range of use-cases.
- Designed to safely provide treatment without developing resistance over time.

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Multiple clinical opportunities with R327 interim **first** in human data expected in 2021.



# **RECCE® 327 – A Synthetic Polymer**

A stable, safe and highly efficacious polymer

#### **Monomers/Polymers**

- Synthetic polymers consist of large molecules
  - Composed of many repeating monomers
- Polymers play essential and ubiquitous roles in everyday life
- Acrolein polymers are typically unstable in physiological conditions
- The polymerisation of acrolein first reported in 1843 – producing a solid polymer which was insoluble in all common solvents and of no significant use.

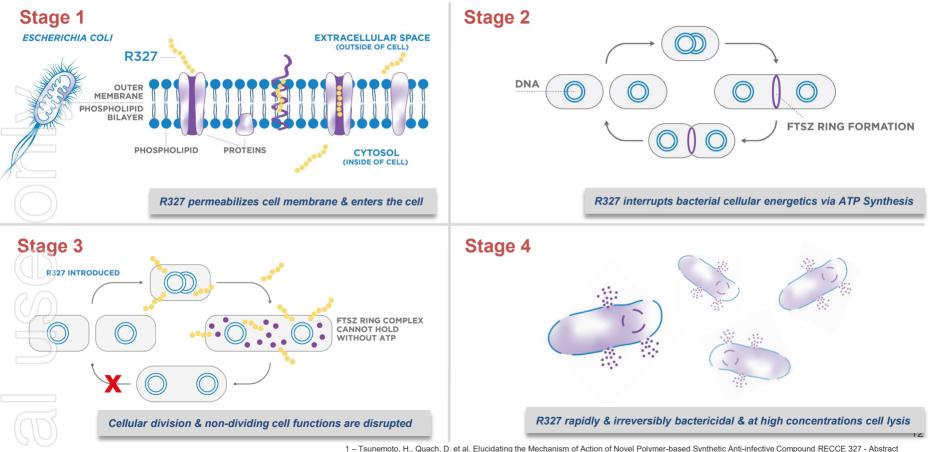


- Raw active ingredient polymerised to create R327
- R327 is a 1-1.5kDa stable polymer
- 100% Soluble at all pH's even to the very acidic (low) pH of the stomach
- Ability to synthesize polymer-antibiotic of chosen molecular weight
  - Facilitate activity in areas outside of intestinal tract
- Accurate manufacturing reproducibility of R327 across multiple batches



## Independent Study Undertaken on R327's MoA<sup>1</sup>

By World Leaders in Bacterial MoA Analysis



# **RECCE® 327 Multi-Layered Mechanism of Action**



R327 rapidly & irreversibly shuts down cellular energetics (adenosine triphosphate (ATP) production) - primary MoA



R327 affects the assembly of bacterial cell division complex, components that require cellular energy to remain assembled. confirming its ability to disrupt cellular bioenergetics



R327 results in the decreased formation of the bacterial cell division complex into ring-like structures (Z-rings) in a concentration dependent manner



R327 permeabilises the cell membrane/alters the integrity of the outer membrane of E. coli cells - intended activity without toxicitv



At higher concentrations and subsequent to ATP shut down cell lysis can occur as a further MoA (bacterial bursting due to their uniquely high internal pressure)



R327 rapidly and irreversibly bactericidal to slow-growing quiescent or stationary phase E. coli cells in addition to actively dividing E. coli cells



Within a minute, the highest concentration of R327 used. 5x MIC, was observed to reduce viable cell counts reported as cell forming units per millilitre of culture (CFU/ml) 100-fold (>1x107 to 1x105 at timepoint 0)



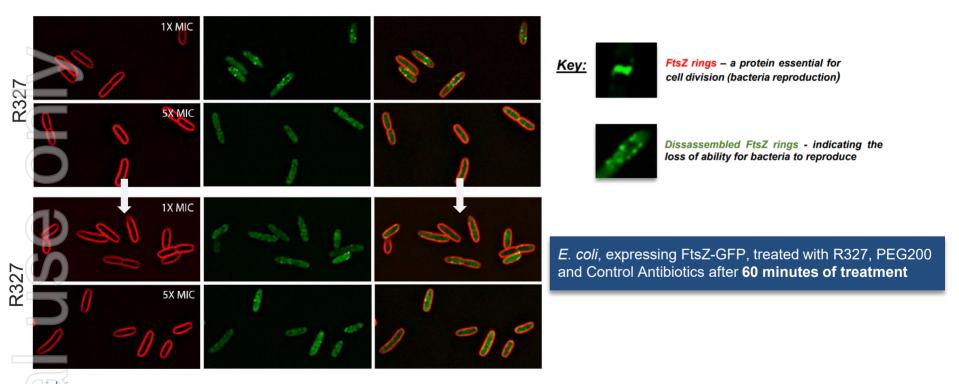
**Current antibiotics rarely retail** bactericidal activities against non-dividing or stationary phase bacterial cells: however, R327 showed remarkable activity against slow-growing bacteria, indicating potential antibacterial activity in biofilms



In comparison to ampicillin and ciprofloxacin, R327 is able to outperform both of these antibiotics in bactericidal activity (measured by viable cell counts) against stationary cells

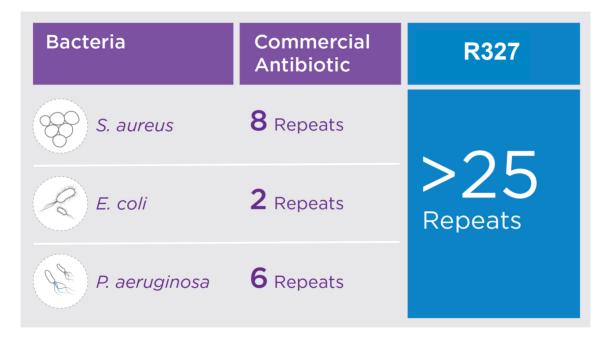
# **RECCE® 327 Mechanism of Action in Practice**

Treatment of R327 against E. coli at 1x and 5x MIC leading to disassembly of the FtsZ-GFP rings, supporting initial studies which indicated R327 inactivates cellular bioenergetics and is rapidly and irreversibly bactericidal.



# **RECCE® 327 Does Not Lose Activity!**

Number of repetitive uses before displaying loss of antibiotic activity



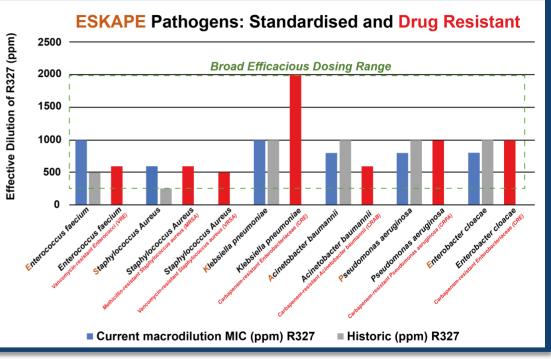
After repetitive use, the commercial antibiotic loses activity; >25 repeats R327 DOES NOT

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\*'Commercial Antibiotic' generates over US \$10bn in revenue 15

# **ESKAPE** Pathogens Can't Escape R327

- Bactericidal activity of R327 demonstrated a three-log or 99.9% reduction against all ESKAPE strains over 24 hrs at various concentrations and times
- R327 remains effective against hypermutated ESKAPE superbugs, including multi-drug resistant (MDR) forms
- Additional time kill concentration studies are underway with drug-resistant bacterial and are expected to be in-line with existing MIC/Time Kill.
- On-track to be the only clinical stage company shown to be efficacious against the full suit of ESKAPE pathogens globally
  - Supported by R327's unique and multilayered MoA

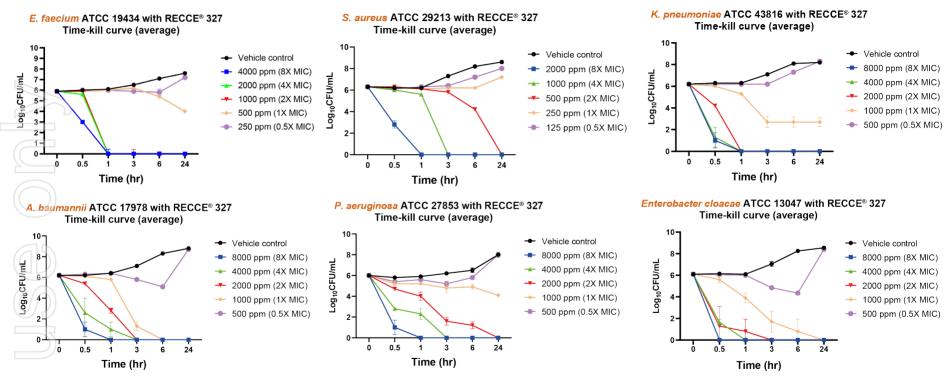


Broad spectrum antibiotic efficacy – drug resistant ESKAPE pathogens especially susceptible to R327 in comparison to standardised bacterial forms



## **ESKAPE** Pathogens Can't Escape R327

On-track to be the only clinical stage company shown to be efficacious against the full suit of ESKAPE pathogens globally



#### Time-kill curves of R327 at various concentrations against strains of ESKAPE pathogens. In the time kill assay, each R327 dilution was tested in duplicate with the average plot shown.

The minimum inhibitory concentration was first determined to define the test concentrations for the time-kill study. The time-kill study was performed to determine the bacterial killing effect of R327 at a total of five concentrations, ranging from 0.5X to 8X, MIC and to measure killing kinetics of treatment with R327 against each strain.

# **R435 Pre-clinical Studies**

Further Pre-clinical Studies planned with R435 against H. pylori

- Murdoch Children's Research Institute (MCRI) to evaluate *in-vivo* antimicrobial activity of R435 oral formulation against *H. pylori* in pre-clinical studies program
- Study led by *H. pylori* infectious disease expert Prof. Philip Sutton
  - Vising mice as a highly validated animal model for *H. pylori*
- MCRI is one of the top three children's health research institutes worldwide for research quality and impact
- Recce and MCRI will work together on the oral antibiotic dosing program with a particular focus on optimal dosing and the effect of R435
- Anticipated completion at approximately mid-2022, at which time Recce may pursue a human clinical trial second half of 2022



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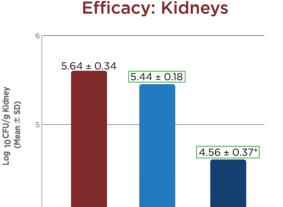
# **Pre-sepsis UTI and Kidney Models in Mice**

#### 

**Efficacy: Bladder** 

\*(P<0.05) significantly different from vehicle control

- Group 1 Bladder E. Coli infection + vehicle control Group 2 – Bladder E. Coli infection + R327 50mg/kg
- Group 3 Bladder E. Coli infection + R327 500mg/kg





RECCE [50mg/kg]

IV 24h infusion

RECCE [500mg/kg]

IV 24h infusion



Single 24-hour intravenous infusion.



Rats treated with RECCE® 327 were observed for any adverse clinical signs remained apparently normal throughout the study.

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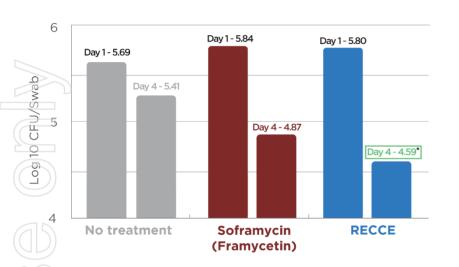
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E. Coli

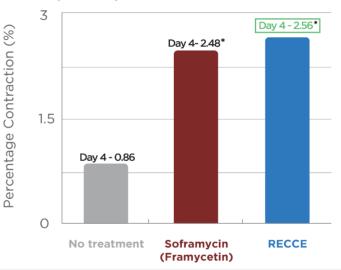
Vehicle Control

# **Topical Efficacy – Wound Infection & Contraction**



#### Superbug Methicillin-Resistant S. aureus (MRSA) in Rats

The Study Director noted: "*RECCE*<sup>®</sup> 327 (100 µl (19.15 mg/ml), topical, once daily, over three days), and **Soframycin** (30 mg, topical, twice daily, Q=12hr, over three days) **showed a significant reduction wound on day four** (p<0.05) when compared to day one, when compared to the vehicle control."

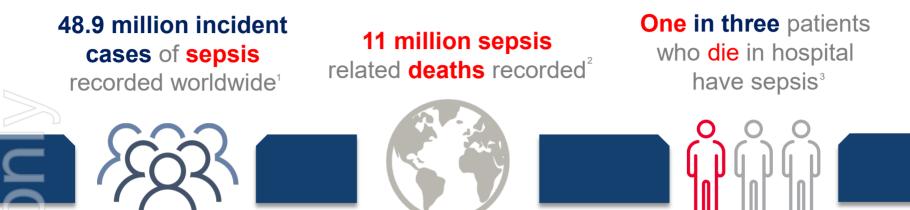


The Study Director noted: "*RECCE*<sup>®</sup> 327 (100 µl (19.15 mg/ml), topical, once daily over three days) showed significant reduction in bacterial load on day four when compared to day one. Soframycin (30 mg, topical, twice daily, Q=12hr, over three days), the current standard of care antibiotic did not show significant efficacy on day four..."

\*Significantly different from vehicle control (p<0.05, 1-way ANOVA) Results from an independent laboratory in USA



## Sepsis – it's a big problem!



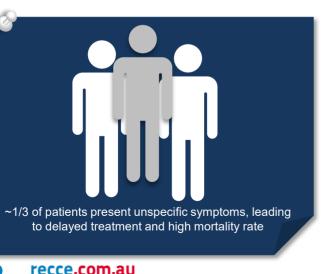
- Sepsis is a life-threatening inflammatory response to infection that has spread in the body.
  - $eq \mathcal{Y}$  Kills more people in the US than prostate, breast cancer and HIV/AIDS combined. $\stackrel{\scriptscriptstyle 4}{\to}$
  - Has been the most expensive condition to treat in the last 8 years double the average cost per stay across all other conditions.<sup>5</sup>
- Currently no drug therapies specifically for the treatment of sepsis.<sup>6</sup>

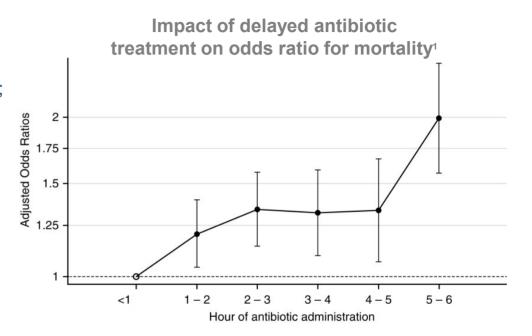
1,2,3 – The Lancet 4 – BioMed Central 5 – University of Texas 6 – International Medicine Journal RACP



## **Treatment Paradigm**

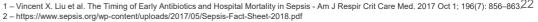
- Current treatment paradigm relies on:
  - Introducing broad spectrum antibiotic(s);
  - Running antibiograms;
  - Adjusting antibiotics based on antibiogram results.





*Early treatment with the correct antibiotic is key to patients' outcome.* 

Mortality from sepsis increases by as much as 8% for every hour that treatment is delayed<sup>2</sup>





# **Phase I Human Clinical Trial**

16,000 mg Study to assess IV infusion of R327 in 80 healthy male subjects as a single ascending dose. 8,000 mg High Dose 10 subjects in each cohort: Formal subject recruitment expected to open for 2 control. 8 R327 4,000 mg enrolments shortly. 2,000 mg Randomized, double blind, placebo controlled, safety, tolerability and pharmacokinetics study. 1,000 mg Single dose of a 1-hour via IV infusion at a uniform rate in 500 mg hospital setting. Low Dose 10 subjects in each cohort: 2 control, 10 R327 150 mg Primary endpoint: vital signs, 12-lead ECG parameters, clinical chemistry, hematology, and urinalysis. 50 mg Interim data expected late 2021 Dav Full data expected H1-2022 Pre-administration -28 screening



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Safety follow up

# **Topical RECCE® 327 - Phase I/II**

- Phase I/II to assess Topical R327 Topical in burn wound infections.
- Sponsored by the South Metropolitan Health Service, Department of Health, Government of Western Australia.

#### Multiple patients have been dosed with R327.

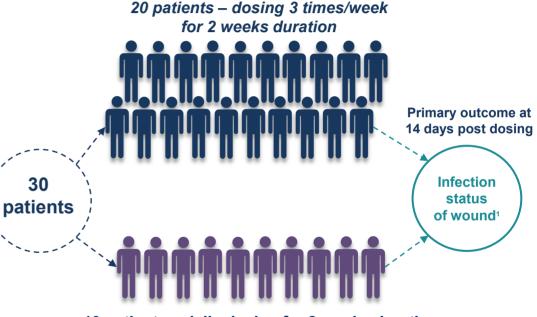
#### Trial Investigators:

 Dr Edward Raby (Clinical Microbiologist and Infectious Diseases expert at Royal Perth and Fiona Stanley Hospitals);

 Professor Fiona Wood (Head of Burns) – worldrenowned burns specialist and spray-on skin pioneer;

- Dr Chris Heath (Head of Infectious Diseases).
- Data expected in CY Q4 2021





10 patients – daily dosing for 2 weeks duration

#### **Strong Pipeline**

#### **Over Various Indications and Upcoming Inflection Points**

	Asset Route of administration	Indications	Discovery	Preclinical	Phase I	Phase II	Phase III	Next data readout	Market Size
<i>Sta</i>	Anti-bacterial programs								
	R327 Intravenous &	Serious/life threatening bacterial infections including sepsis			)	-		Phase I interim data readout Q4 2021	47-50 million cases worldwide
	Intranasal	Pre-sepsis - kidney & UTI infections		)		(	To start post Phase Il in sepsis		
	R327 Topical	Wound infections including infected burns			)			Phase I/II Data CY Q4 2021	11 million burn wound cases requiring medical intervention. Majority of which escalate to infection
	R435 Oral R529	Helicobacter pylori in stomach ulcers							Up to 4.4 billion worldwide
	Anti-viral programs								
-	R327 Nasal	COVID & Influenza							
	R529 IV and Intranasal	COVID							

# **IP, Regulatory and Market Access**

Recce's patent portfolio includes more than 20 issued patents and patent applications in the world's major markets, including the United States, Europe, Japan, China and Australia.

Filed	Patent Family 1	Expiry	Patent Family 2	Expiry	Patent Family 3	Expiry
Australia	$\checkmark$	2028	$\checkmark$	2035	Pending	2037
USA	$\checkmark$	2029	$\checkmark$	2035	$\checkmark$	2037
Europe	√	2028	$\checkmark$	2035	$\checkmark$	2037
Japan	$\checkmark$	2028	$\checkmark$	2035	$\checkmark$	2037
China	$\checkmark$	2028	Pending	2035	$\checkmark$	2037

**Patent Family 1** – Antimicrobial Polymers and their Compositions.

Patent Family 2 – Copolymer for use in Method of Treatment of a Parenteral Infection.

**Patent Family 3 –** Anti-Virus Agent and Method for Treatment of Viral Infection.

Granted

The FDA has awarded R327 **Qualified Infectious Disease Product** designation for bacteriemia (G+/G-) under the **Generating Antibiotic Initiatives Now (GAIN) Act** – labelling it for **Fast Track Designation**, plus **10 years of market exclusivity post approval**.



## **Insourced Manufacturing Capabilities**



Wholly owned, automated manufacturing facility in Sydney's Macquarie Park



Raw materials plentiful and cheap – few \$/Kg.
No expensive waste – 99.9% product yield.



- Automated manufacture process taking approximately 1 hour.
- **500 doses** per fully automated run.



Currently producing in volumes to support planned Phase I & II clinical trials.



 Facility built to pharmaceutical specification.
Packaging and labelling to international 'tamper-proof' standards.



# **Empowering Clinicians with a New Class of Antibiotics**

#### The need for new antibiotics has never been greater

- ▶ Initial resistance to use new approved drugs due to antibiotic resistance
- **New antibiotics**, able to kill drug-resistant bacteria, is **essential** to saving modern medicine."
  - Wellcome Trust
- "Lack of new antibiotics threatens global efforts to contain drug-resistant infections."
  - World Health Organization

#### R327 addressing market need

- **R327 does not contribute to AMR**, supported by unique and multi-layered MoA.
  - **Empowering clinicians** to **confidently** and **quickly administer R327** at first patient presentation.
- Use of R327 may alleviate the selective pressure on bacteria posed by other antibiotics and allow them to regain efficacy.

#### **Physician perspectives on R327**

"We have so few options when patients have difficult pathogens. This agent would be great to come into play for them." – ID KOL

"This may start off being used in resistant patients, but if it is really compelling, of course physicians will use it for more people." – Pulm. KOL

*"If a patient has M. abscessus, they're fortunate if they get any improvement, and there's sometimes potentially permanent damage." – Pulm. KOL* 



# Pharmaceuticals

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# Thank you

John Prendergast, PhD Chairman Recce Pharmaceuticals Ltd

section 1 2 9256 2571
iohn.prendergast@recce.com.au
ASX:RCE | FSE: R9Q

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