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Editor

Antibiotic Resistance

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Preface

Antibiotics have changed the face of medicine since the early part of the twentieth century. The Achilles' heel of antibiotics is resistance which has arisen to all marketed compounds. This sets antibiotics apart from other groups of medicines, because the former become obsolete over time as resistance to them increases. So, in order to maintain an effective arsenal of anti-infectives, it is necessary, at regular intervals, to invent new ones, develop them and then market them. Unfortunately, the emergence of resistance has outpaced the rate of replacement of obsolete antibiotics with new effective compounds. This situation threatens the practice of modern medicine.

Bacteria have existed on earth for over 3 billion years. During that time they have produced numerous antibiotics, and in order to survive, they have developed resistance to these compounds. Whilst we tend to think of individual species which are multi-drug resistant, bacteria are thought to operate together as a "Resistome" which contains pathogenic and non-pathogenic bacteria that cooperate in the exchange of resistance genes.

What hope is there for the human race? The first rule in any war is that intelligence is paramount. Surveillance of the enemy, in this case bacterial resistance, is the bedrock of the fight. The medical microbiologists and infectious disease clinics use this information to choose the right antibiotics to treat infected patients. Companies, which make new antibiotics, are advised which beta-lactamase to block and what species of bacteria are becoming most resistant. It is a slowly moving front, taking decades to shift; the Gram-positive antibiotics are currently pushing back their bacterial foes, whilst the Gram-negatives seem to be in the ascendant. The scientists are trying to devise new ways to win the war but have suffered a series of setbacks including the failure of the genomics programme to lead to any novel marketed antibiotics. However, it is possible that we can learn from the tuberculosis treatment arena, in which combinations have proven a success, although resistance is also now becoming a major problem in this disease. A new dimension in the battle may come from targeting non-multiplying bacteria, which are also called persisters. This is because virtually all clinical infections contain non-multiplying bacteria which exist alongside multiplying ones. The problem with non-multiplying bacteria

is that they cannot be readily killed by most marketed antibiotics, which means that the therapy is prolonged, and this can lead to more genetic-resistant mutants. Alternatively, perhaps we can reduce the overall emergence of resistance by simply reducing our usage of antibiotics in medicine, textiles and animals or maybe we can harness the power of, for example, efflux pumps to make new effective antibiotics.

I hope that this volume will give the reader a new angle on the subject of antibiotic resistance, which will be valuable to both those who have many years of experience and those who are new to the field. It describes the problem of growing resistance, our failure to market enough antibiotics to cope with this resistance, particularly for Gram-negatives, and its origins. The volume also covers ways that we can deal with antibiotic resistance, such as surveillance, infection control, combinations of antibiotics, targeting non-multiplying persisters or focussing on efflux pumps. Finally it describes how we can perhaps reduce usage of antibiotics and so decrease the rate of emergence of resistance.

I also hope that this book will highlight the excitement in the antibiotic resistance field and the successes of what has been and will continue to be one of the pillars of modern medicine. The future will bring unimaginable ingenuity of new bacterial resistance mechanisms and, hopefully, equally brilliant scientific advances in antibiotic research.

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Contents