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Commentary

A Brief Note on Identification of Antimicrobial Peptides

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1. Description

The growing problem of antimicrobial resistance in health care is due to the increased use of antibacterial agents during the COVID-19 epidemic. The need for new antibiotics is high, but the arsenal of available agents is dwindling, especially for the treatment of infections caused by Gram-negative bacteria such as *Escherichia coli, Pseudomonas aeruginosa, Chlamydia trachomatis,* and *Yersinia pestis*. Antimicrobial Peptides (AMPs) provide a good path for novel antibiotic development and use in-deep learning techniques for successful AMP design. AMPs are inherent in the innate immune system and have broad-spectrum antimicrobial properties that help in defense against microbial attack. They are usually small cationic peptides of 100 amino acids, which often adopt an alpha-helical secondary structure with amphiphilic surface properties and are considered essential for establishing antimicrobial activity. The main mechanism of action of AMPs is the disruption of the cell membrane and target microorganisms by hydrophobic or electrostatic interactions, which cause lysis of the cell. AMPs offer a number of advantages over conventional small-molecule antibiotics, including rapid killing of bacteria with broad-spectrum action, antimicrobial immuno modulatory effects, and lower probability of developing antimicrobial resistance.

The main advantage of in-depth learning, especially in the big data age, is the ability to automatically extract generalizations and complex features from large amounts of raw data. The deep learning feature also reduces the need for engineering, which requires expert knowledge in the subject domain. Long-Term Memory models are a popular type of repetitive neural network and have led to success in numerous studies on the classification and production of AMP. Variation of LSTM, bidirectional LSTM, is often used in natural-language processing and other order-based issues, including the classification of AMP sequences.

2. Future Perspective on Clinical Application

The results obtained indicate that LSTM in-depth learning models are good tools in the search for new antibacterial drug leads and may help accelerate the novel antibiotics discovery process. Future synthesis and *in vitro* testing of de novo AMPs should be performed to confirm in silico results. However, multiple barriers must be considered in order for AMP to become an effective antimicrobial drug. The majority of AMPs do not have the proper function and must be improved in terms of pharmacokinetic and pharmacodynamics properties before they can act as therapeutic drugs. AMPs are constantly depleted during their transport throughout the body, e.g., clearance through the intestines, tissue proteases, serum proteases, and kidneys, resulting in reduced serum half-life, limiting their potential for systemic therapeutic use. Another major concern in the clinical use of AMPs is toxicity, which has not yet been fully elucidated. The toxicity of AMPs against eukaryotic cells, including their hemolytic action, causes lysis in human red blood cells. Rational design of novel short peptides helps to overcome the above obstacles by tuning their properties and reducing toxins. Therefore, these AMPs have the potential to play an important role in the future development of treatments against resistant bacteria. Future designs could be improved to take into account the design of AMPs that work synergistically with other antibiotics, as this allows the use of lower doses of each antibiotic, limiting toxicity,

and in some cases inhibiting the development of bacterial resistance. Such studies require additional data containing already known examples of good combinations with chloramphenicol and amoxicillin-clavulanate and imipenem. Therefore, peptidomycetes based on successfully developed AMPs or AMPs are likely to be used in conjunction with our current arsenal of conventional antibiotics to increase in antimicrobial resistance.