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Integrated One Health Strategies for Cutting-Edge Animal Disease Diagnosis, Preventing and Treatment

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Animal diseases present significant challenges to public health, agriculture, and biodiversity. The need for advanced diagnostic and therapeutic approaches is critical to ensuring animal welfare, food security, and human health. This proposal outlines a multidisciplinary strategy that integrates cutting-edge molecular techniques, computational methods, and the One Health approach to enhance animal disease diagnosis and treatment.

Key components include the utilization of advanced molecular techniques such as Polymerase Chain Reaction (PCR), Next-Generation Sequencing (NGS) and Oxford Nanopore DNA/RNA sequencing technology for precise, real-time pathogen detection.

We will be able to quickly detect the infectious agent causing disease outbreaks and conduct cutting-edge research in animal microbiome and microbiology by applying state-of-the-art nanotechnology.

CRISPR-based diagnostics offer rapid and accurate pathogen characterization, aiding in the development of targeted therapies. Structure-based drug design, supported by molecular docking and dynamics, facilitates the discovery of novel therapeutics, while drug repurposing accelerates the identification of effective treatments.

In silico techniques, including virtual screening and machine learning, optimize drug design and predict ligand-target interactions. Nanobioinformatics combines nanotechnology and bioinformatics to improve drug delivery systems and vaccine efficacy. Immunobioinformatics enables the prediction of epitopes and the modelling of immune responses, crucial for vaccine development.

The One Health approach promotes interdisciplinary collaboration to address the interconnected health of humans, animals, and the environment. Integrated surveillance systems and environmental health studies are essential to mitigating the spread of animal diseases.

PhD and MSc students will play a pivotal role in this initiative, engaging in research projects that enhance diagnostic tools, analyze genomic data, and develop new therapeutics. They will receive training in molecular biology, computational skills, and interdisciplinary collaboration, supported by mentorship programs and networking opportunities.

The expected outcomes include improved diagnostic accuracy, improving veterinary public health and food safety capacity, the development of novel therapeutics, and the establishment of integrated health strategies. This initiative aims to position the research group as a leader in animal health research, contributing significantly to global efforts in disease management and prevention.

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