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Virtual Reality Module Depicting Catheter-Associated Urinary Tract Infection as Educational Tool to Reduce Antibiotic Resistant Hospital-Acquired Bacterial Infections

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BACKGROUND AND AIMS

- The rise in global burden of infectious diseases accompanied with the significant rise in antibiotic resistance world-wide prompt immediate action to combat the emerging threat of antibiotic resistance in bacteria. The VR-CAUTI module is designed to bring awareness and provide insights to health care providers and community which help in reducing the burden and spread of antibiotic resistant infections.

- The aim of this research is to develop a virtual reality (VR) based educational tool depicting the process of CAUTI caused by antibiotic resistant bacteria.

- Urinary tract infections are common bacterial infections. Urinary catheters are commonly used in hospitalized patients and catheter associated urinary infections (CAUTI) are the leading cause of hospital-acquired infections. Due to biofilm formation, antibiotic resistance in CAUTI are associated with increased mortality and the burden of hospital-acquired infections.

All images were taken in real time play.

Fig 1: Screenshots from the module in real-time
A: Interaction of Ciprofloxacin with E.Coli.
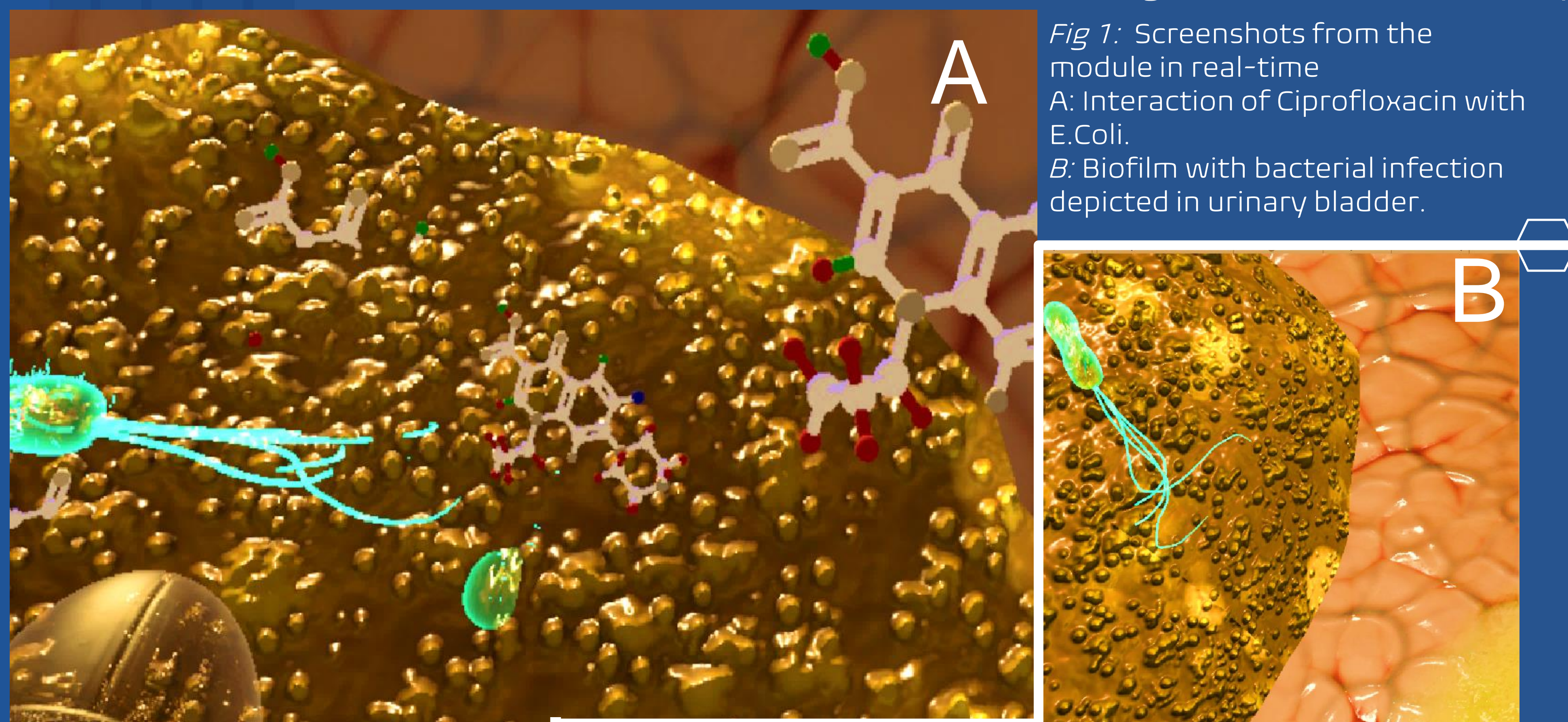*B:* Biofilm with bacterial infection depicted in urinary bladder.

Fig 2: E.Coli found on Foley's Catheter, entering through the urethra.

CONCLUSION

- This VR-CAUTI module is the proof-of-concept for designing detailed VR based scientifically very accurate medical simulation that could be used in medical education to maximize learning outcomes.

- VR based modules have the potential to transform and revolutionize learning experience and render medical education compatible with the IoT in the current 4th industrial revolution.

METHODS

- At its initial stages, this module was planned using a storyboard template. The SteamVR Plugin along with Unity were used to put the module together and create animations. Blender, Cinema4D, and Sculptris were used to create the bladder, bacteria and catheter, whilst Substance 3D Painter was used to create and edit the textures. Ciprofloxacin's model was imported from Jmol into Blender.

- To render the module more engaging, the concept of antibiotic resistance is illustrated with a twist. To this end, the User will be able to first-handedly experience shooting at the biofilm with a 'Ciprofloxacin gun'.

Fig 3: Final bladder model.
Top: Depiction of the inner texture of the bladder.
Bottom: Depiction of the final model of the bladder exterior.