



## Replication of human noroviruses in stem cell-derived human enteroids (Ettayebi, K. et al. Science, 2016)

### Abstract

Human noroviruses (NoV) are the most common cause of epidemic and sporadic cases of acute gastroenteritis worldwide, and the leading cause of food-borne gastroenteritis. Human NoV have become the predominant gastrointestinal pathogen within pediatric populations in developed countries. Human NoV have resisted significant efforts to be cultivated in a laboratory setting for over 40 years which has been a major barrier to research and development of effective interventions for human NoV. The same applies to surface disinfectants. Since NoV cannot be cultured in the lab, agencies such as Health Canada, the EPA and FDA list no specific test method for testing disinfectants against human NoV.

### The Research Article

Recently, Dr. Mary Estes and her team at Baylor College of Medicine successfully cultured human norovirus in intestinal cells. The researchers made new epithelial cell cultures from crypts (a small tubular gland) from adult human intestinal tissue. Under the right conditions, the stem cells in the crypts multiply and form the surface layer of our gut to become mini guts. These mini guts function like the tissue they came from and can be used indefinitely. The mini-guts were inoculated with human norovirus, and after 72 hours, the researchers saw far more viral genetic material than they initially added, indicating that the virus was infecting and invading the cells. Through careful experimentation, the research team identified that human bile greatly increased virus yields.

### Noroviruses

NoV belong to the family Caliciviridae, and are non-enveloped viruses and thus more resistant to disinfectants than enveloped viruses. Human NoV are highly contagious, with rapid person-to-person transmission directly through the fecal-oral route and indirectly from contact with contaminated fomites, or consumption of contaminated food or water. The inability to culture NoV in the lab has been a barrier to a better understanding of how they infect cells, cause disease and how the immune system responds to them. Additionally, there is no approved method for testing disinfectants against human NoV. In such cases, regulatory bodies allow the use of carefully chosen surrogates which can be worked on safely and easily in the lab. In the case of human NoV, regulatory bodies recommend the Feline Calicivirus (FCV) as the surrogate that has similar qualities to Norovirus. Therefore, if products can prove effectiveness against FCV, a claim of efficacy against human NoV can be made.

### Conclusions

While the reported work of Dr. Estes and her team is a significant step forward in the lab culture of human NoV, it will require validation and simplification for routine use at a commercial scale. In addition, it will require the approval by the relevant regulators for adoption in testing of disinfectants. For now the use of suitable surrogate viruses for testing disinfectants will continue to be the acceptable practice. Furthermore, it is too early to know if the lab-grown human NoV will prove to be as resistant as or more resistant than FCV or cultivable animal NoV. Only in case of a conclusively demonstrated higher disinfectant resistance compared to the currently accepted surrogates, will we need to review the current formulations.

### Implications for AHP®

Accelerated Hydrogen Peroxide® (AHP) is a globally patented oxidizing-based chemistry with a broad spectrum of efficacy against a variety of important pathogens, including the currently approved surrogates for human NoV.

#### AHP® Disinfectants are One-Step Disinfectant Cleaners

- AHP® has superior cleaning efficiency which results in lower costs and faster results.

#### AHP® Disinfectants have realistic contact times

- Short contact times ensure surfaces remain wet for the required contact time, providing comfort and confidence that disinfection has occurred.

#### AHP® Disinfectants provide the perfect balance between safety and efficacy

- AHP's® non-toxic, non-irritating to eyes and skin and non-skin sensitizing formula is designed to be easier on employees and occupants resulting in protocol compliance.

#### AHP® Disinfectants are compatible

- AHP® formulations are tested to ensure compatibility that preserves your investments in equipment, furniture, and building surfaces.

#### AHP® Disinfectants are environmentally sustainable

- AHP's® active ingredient, hydrogen peroxide, breaks down into water and oxygen leaving no active residues and will not negatively impact indoor air quality.

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