

# NOVEL HUMAN ASTROVIRUS SEQUENCES FOR DIAGNOSTICS AND VACCINE DEVELOPMENT FOR ENCEPHALITIS AND GASTROENTERITIS

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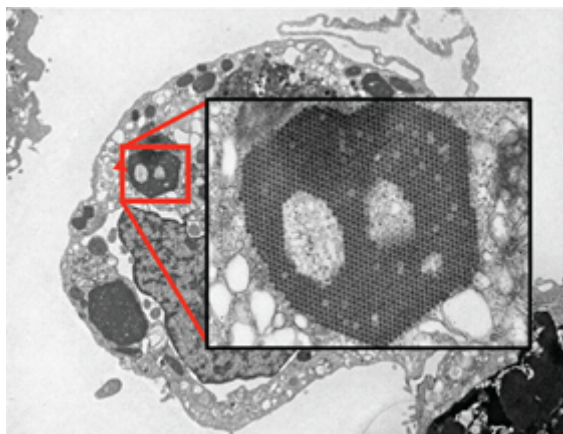
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## Technology Description

A team of researchers at Washington University and the Centers for Disease Control discovered, sequenced and patented a novel human astrovirus that can cause encephalitis and gastroenteritis (non-etiological diarrhea), offering a path to detection and diagnostics.

The virus (Astrovirus VA1, “VA1”, also known as HMO-C, VA1 mamastrovirus 9) was first identified from an outbreak of gastroenteritis in a childcare center. Subsequent studies demonstrated that astroviruses (a family of small, single-stranded, positive sense RNA viruses) are an emerging cause of central nervous system (CNS) infection. Furthermore, VA1 is the most prevalent astrovirus in cases of human encephalitis and these infections have a high mortality rate. In addition, the inventors have created the first cell culture system for this virus to facilitate research and development of VA1-based diagnostics and therapeutics. This technology could help fill a diagnostic gap and an unmet medical need for viral gastroenteritis and encephalitis.



**Figure 1.** Electron micrograph of astrovirus VA1 infected cell showing crystalline lattice of viral particles.

## Stage of Research

**Virus identification:** After identifying VA1 as the cause of a gastroenteritis outbreak, the inventors sequenced the 6586 nucleotide viral genome and demonstrated that it was highly divergent from all previously described astroviruses.

**Cell culture:** The inventors have successfully propagated VA1 in multiple human cell lines (Caco2, HEK293T, A549 and SK-N-SH) as well as primary human astrocytes, a necessary tool to facilitate

development of diagnostics, vaccines or anti-viral drugs as well as basic research studies of tropism, pathogenesis, and immune control.

*Future studies:* The inventors' future work will focus on developing additional cell culture and in vivo models of VA1 CNS infection.

## Applications

- **Viral diagnostics:**
  - molecular diagnostics of astrovirus nucleic acid to identify viral agents that cause encephalitis or gastroenteritis
  - cell culture to develop antibody- or antigen-based diagnostics
- **Vaccine development** – astrovirus cell culture to identify critical antigens for vaccine development as well as protective antibodies
- **Research** – basic research into viral pathogenesis including neurotropism and neuropathogenesis
- **Drug screening** – cell culture model may also facilitate high-throughput screens for antiviral agents to treat VA1 infections

## Key Advantages

- **Propagated in multiple cell lines** – the inventors have developed cell culture techniques to propagate the virus in cell culture which facilitates research and development of VA1-based products
- **Fills diagnostic gap:**
  - the etiologies of 12-41% of all gastroenteritis outbreaks remain undetermined even after extensive testing; VA1-based diagnostics could be included in diagnostic panels to fill this gap
  - ~65% of encephalitis cases have no known etiology; VA1-based diagnostics could be included in diagnostic panels to fill this gap
- **Unmet medical need** – there is a high mortality rate in patients with VA1-associated encephalitis; therefore, diagnostics, vaccines and anti-viral therapies for VA1 could improve patient outcomes

## Publications

- Janowski AB, Klein RS, Wang D, [Differential in vitro infection of neural cells by astroviruses](#). *mBio* 2019 Jul 9;10(4). pii: e01455-19.
- Janowski, A. B., Bauer, I. K., Holtz, L. R., & Wang, D. (2017). [Propagation of astrovirus VA1, a neurotropic human astrovirus, in cell culture](#). *Journal of virology*, 91(19), e00740-17.
- Finkbeiner, S. R., Li, Y., Ruone, S., Conrardy, C., Gregoricus, N., Toney, D., ... & Tong, S. (2009). [Identification of a novel astrovirus \(astrovirus VA1\) associated with an outbreak of acute gastroenteritis](#). *Journal of virology*, 83(20), 10836-10839.

## Patents

- [Identification of astrovirus VA1 associated with gastroenteritis in humans](#) (U.S. Patent No. 8,426,574)

## Website

- David Wang: [Profile](#) and [Wang Lab](#)