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# Atara Biotherapeutics Announces Publication of New Research Linking Epstein-Barr Virus (EBV) Infection and Multiple Sclerosis (MS)

SOUTH SAN FRANCISCO, Calif., June 13, 2018 (GLOBE NEWSWIRE) -- Atara Biotherapeutics, Inc. (Nasdaq:ATRA), a leading off-the-shelf, allogeneic T-cell immunotherapy company developing novel treatments for patients with cancer, autoimmune and viral diseases, today announced publication of new research findings advancing the understanding of Epstein-Barr Virus (EBV) infection in the multiple sclerosis (MS) brain. The research was carried out in collaboration with investigators at Stanford University School of Medicine and QIMR Berghofer Medical Research Institute. The findings are being reported in an article online and to be published in the July 2018 print issue of *Neurology: Neuroimmunology & Neuroinflammation*, an official journal of the American Academy of Neurology.

“The *Neurology* publication extends the growing body of evidence linking EBV infection and MS using a well-characterized MS brain tissue bank,” said Chris Haqq, M.D., Ph.D., Executive Vice President of Research and Development and Chief Scientific Officer of Atara Biotherapeutics. “We observed that EBV is present in both MS and control brains, with EBV-infected B cells and plasma cells more prevalent and localized to MS brain lesions in the parenchyma. By contrast, EBV-infected B cells and plasma cells in non-MS brains were shown to be localized to vascular tissues. These findings advance the understanding of EBV’s potential role in MS pathogenesis and provide support for targeting EBV-infected immune cells associated with chronic MS lesions as a potential treatment for this severe autoimmune disorder.”

Findings in the article titled ‘Molecular signature of Epstein-Barr virus infection in MS brain lesions” included:

- EBV infection was detectable by immunohistochemistry and *in situ* hybridization, in both MS and non-MS brains.
- Immune cells positive for EBV-encoded RNA (EBER) were observed in 85% of MS brains, whereas non-MS brains seldom contained EBER-positive cells.
- Latent virus was more prevalent in MS brains, with lytic virus restricted to chronic MS lesions.
- EBV infection was associated with vascular structures in non-MS brains.
- EBV latent membrane protein 1 (LMP-1) was present in 93% of MS and 78% of control brains, with a greater percentage of MS brains containing CD138+ plasma cells and LMP-1–rich populations.
- EBV early lytic protein (BZLF1), was also observed in 46% of MS brains, primarily in association with chronic lesions, and 44% of non-MS brain tissue.

**About Multiple Sclerosis**
MS is a chronic neurological autoimmune disease that affects an estimated 2.3 million people around the world. Relapsing-remitting MS (RRMS) is the most common form of MS and is characterized by episodes of new or worsening signs or symptoms (relapses) followed by periods of recovery. Despite available disease-modifying treatments, most individuals with RRMS continue to experience disease activity and disability progression.

Progressive MS (PMS) is a severe form of the disease with few therapeutic options. PMS comprises two conditions, both characterized by persistent progression and worsening of MS symptoms and physical disability over time. Primary Progressive MS (PPMS) occurs when continuous progressive disease is present at diagnosis and occurs in approximately 15% of newly diagnosed cases. Secondary Progressive MS (SPMS) initially begins as RRMS and develops into a progressive form. Up to 80% of people with RRMS will eventually develop SPMS. There is substantial unmet medical need for new and effective therapies for patients with PPMS and SPMS. Most treatment options that work well in reducing flares in RRMS have not been shown to be effective in slowing or reversing disability in PMS.

**About ATA188 and ATA190**
Epstein-Barr Virus (EBV) is associated with a wide range of hematologic malignancies and solid tumors, as well as certain autoimmune conditions such as multiple sclerosis (MS). T-cells are a critical component of the body's immune system and can selectively target specific EBV antigens believed to be important for the potential treatment of MS. Off-the-shelf ATA188 and autologous ATA190, using Atara's complementary T-cell immunotherapy technology developed by Professor Rajiv Khanna at QIMR Berghofer, have the potential to precisely recognize and eliminate EBV-infected B-cells and plasma cells in the central nervous system that may catalyze autoimmune responses and MS pathophysiology. Professor Michael Pender from The University of Queensland presented updated results from the first autologous ATA190 study, which was partially funded by MS Research Australia, MS Queensland and Perpetual Foundation, at the MSParis 2017 Congress, the 7th Joint ECTRIMS and ACTRIMS Meeting, in October 2017. This study tested adoptive immunotherapy in patients with MS and showed that autologous ATA190 led to encouraging clinical improvements in MS symptoms that correlated with autologous ATA190's reactivity against target EBV antigens (EBV reactivity). In addition to the ongoing Phase 1 autologous ATA190 clinical study in patients with progressive MS, Atara is advancing a Phase 1 ATA188 clinical study in patients with progressive or relapsing-remitting MS across clinical sites in the U.S. and Australia.

**About Atara Biotherapeutics, Inc.**
**Atara Biotherapeutics, Inc.** (**@Atarabio**) is a leading T-cell immunotherapy company developing novel treatments for patients with cancer, autoimmune and viral diseases. The Company's off-the-shelf, allogeneic T-cells are bioengineered from donors with healthy immune function and allow for rapid delivery from inventory to patients without a requirement for pretreatment. Atara's T-cell immunotherapies are designed to precisely recognize and eliminate cancerous or diseased cells without affecting normal, healthy cells. Atara's most advanced T-cell immunotherapy in development, tabelecleucel, or tab-cel™ (formerly known as ATA129), is being developed for the treatment of patients with Epstein-Barr virus (EBV) associated post-transplant lymphoproliferative disorder (EBV+ PTLD) who have failed rituximab, as well as other EBV-associated hematologic and solid tumors, including nasopharyngeal carcinoma (NPC). Tab-cel™ is in Phase 3 clinical development for the

treatment of EBV+ PTLD following an allogeneic hematopoietic cell transplant (MATCH study) or solid organ transplant (ALLELE study). Atara is also developing off-the-shelf, allogeneic ATA188 and autologous ATA190 T-cell immunotherapies using a complementary targeted antigen recognition technology for specific EBV antigens believed to be important for the potential treatment of multiple sclerosis (MS). A Phase 1 clinical study of autologous ATA190 in patients with progressive MS is ongoing. Atara also is advancing a Phase 1 ATA188 clinical study in patients with progressive or relapsing-remitting MS across clinical sites in the U.S. and Australia in March 2018. Atara's clinical pipeline also includes ATA520 targeting Wilms Tumor 1 (WT1) and ATA230 directed against cytomegalovirus (CMV).

**Forward-Looking Statements**
This press release contains or may imply "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934. For example, forward-looking statements include statements regarding the Company's enrollment, expansion, expected results and completion of its Phase 1 studies in MS; the Company's ability to leverage its platform in other indications and initiate development of additional immunotherapies; and the potential advantages of its product candidates. Because such statements deal with future events and are based on Atara Biotherapeutics' current expectations, they are subject to various risks and uncertainties and actual results, performance or achievements of Atara Biotherapeutics could differ materially from those described in or implied by the statements in this press release. These forward-looking statements are subject to risks and uncertainties, including those discussed under the heading "Risk Factors" in Atara Biotherapeutics' quarterly report on Form 10-Q filed with the Securities and Exchange Commission (SEC) on May 8, 2018, including the documents incorporated by reference therein, and subsequent filings with the SEC. Except as otherwise required by law, Atara Biotherapeutics disclaims any intention or obligation to update or revise any forward-looking statements, which speak only as of the date hereof, whether as a result of new information, future events or circumstances or otherwise.

**INVESTOR & MEDIA CONTACTS:**

**Investors:**
John Craighead, Atara Biotherapeutics
650-410-3012
jcraighead@atarabio.com

Steve Klass, Burns McClellan
212-213-0006 x331
sklass@burnsmc.com

**Media:**
Justin Jackson, Burns McClellan
212-213-0006 x327
jjackson@burnsmc.com


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