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# Titan Pharmaceuticals and Walter Reed Army Institute of Research Collaborate to Evaluate ProNeura Antimalarial Implants

## Initial non-clinical studies with ProNeura implants incorporating antimalarial drugs demonstrate proof-of-concept

SOUTH SAN FRANCISCO, Calif., July 6, 2017 /PRNewswire/ -- [Titan Pharmaceuticals, Inc.](#) (NASDAQ: TTNP), a specialty pharmaceutical company developing proprietary therapeutics for the treatment of select chronic diseases utilizing its ProNeura™ long-term, continuous drug delivery technology, announced today that it has entered into a Cooperative Research and Development Agreement (CRADA) with Walter Reed Army Institute of Research (WRAIR) and Southwest Research Institute (SwRI) to evaluate the development of ProNeura-based implants for a long-term regimen in the prevention of malaria.



"The Walter Reed Army Institute of Research has been involved with testing virtually every drug approved by the U.S. Food and Drug Administration for protection against malaria, and we are excited to be collaborating with the organization on this important endeavor," said Titan President and CEO Sunil Bhonsle. "ProNeura's ability to provide long-term, continuous drug delivery could represent an important advance over current approved daily dosed antimalarial products."

Initial non-clinical studies have demonstrated preliminary proof-of-concept and the results were recently presented by the Experimental Therapeutics (ET) branch of WRAIR at the 2017 Asia Pacific Military Health Exchange (APMHE) in Singapore. ProNeura implants containing piperazine, an effective compound against blood stage parasites, were formulated at SwRI and tested at WRAIR in a mouse model infected with *Plasmodium berghei*, to characterize the pharmacokinetic (PK) release profile and long-term prophylactic efficacy. Piperazine implants demonstrated sustained drug release for 6 weeks of PK analysis, and exhibited sufficient suppression of early blood stage malaria in infected mice, as assessed by IVIS (*In Vivo* Imaging System). Furthermore, complete protection from infection with *Plasmodium berghei* parasites was demonstrated for up to 8 weeks post-

implantation in mice. In addition, the sustained release of other antimalarial drugs, atovaquone and doxycycline, were demonstrated *in vivo* with their respective ProNeura-based implants.

There is an important need for a reliable long-term regimen for the prevention of malaria in resource-constrained environments. The development of long-acting implants could greatly improve compliance with a reliable treatment regimen, potentially allowing ground combat forces to maneuver and perform in an uninterrupted manner. The preliminary findings of the study allow WRAIR to pursue additional studies with long-acting ProNeura implants that include FDA-approved anti-malarial drugs.

"We look forward to a constructive research collaboration with Titan Pharmaceuticals and Southwest Research Institute on sustained-release antimalarial implants," said Lt. Col. Mara Kreishman-Deitrick, PhD, director of ET at WRAIR.

### **About Titan Pharmaceuticals**

Titan Pharmaceuticals Inc. (NASDAQ: TTNP), based in South San Francisco, CA, is developing proprietary therapeutics primarily for the treatment of serious medical disorders. The company's lead product is Probuphine®, a novel and long-acting formulation of buprenorphine for the long-term maintenance treatment of opioid dependence. Probuphine employs Titan's proprietary drug delivery system ProNeura™, which is capable of delivering sustained, consistent levels of medication for three months or longer. Titan has granted commercial rights in the U.S. and Canada for Probuphine to Braeburn Pharmaceuticals. Approved by the U.S. Food and Drug Administration in May 2016, Probuphine is the first and only commercialized treatment of opioid dependence to provide continuous, around-the-clock blood levels of buprenorphine for six months following a single procedure. The ProNeura technology has the potential to be used in developing products for treating other chronic conditions such as Parkinson's disease and hypothyroidism, where maintaining consistent, around-the-clock blood levels of medication may benefit the patient and improve medical outcomes. For more information about Titan, please visit [www.titanpharm.com](http://www.titanpharm.com).

*This press release may contain "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. Such statements include, but are not limited to, any statements relating to our product development programs and any other statements that are not historical facts. Such statements involve risks and uncertainties that could negatively affect our business, operating results, financial condition and stock price. Factors that could cause actual results to differ materially from management's current expectations include those risks and uncertainties relating to the commercialization of Probuphine, the regulatory approval process, the development, testing, production and marketing of our drug candidates, patent and intellectual property matters and strategic agreements and relationships. We expressly disclaim any obligation or undertaking to release publicly any updates or revisions to any forward-looking statements contained herein to reflect any change in our expectations or any changes in events, conditions or circumstances on which any such statement is based, except as required by law.*

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