**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS**

TEVA PHARMACEUTICALS INTERNATIONAL GMBH and TEVA PHARMACEUTICALS USA, INC., Plaintiffs, v. ELI LILLY AND COMPANY, Defendant.	Civil Action No. 1:18-cv-12029-ADB

EXPERT DECLARATION OF JEFFREY V. RAVETCH, M.D., PH.D.

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I.   INTRODUCTION

1.   I, Jeffrey V. Ravetch, M.D., Ph.D., have been asked by Plaintiffs Teva Pharmaceuticals International GmbH and Teva Pharmaceuticals USA, Inc. (collectively, "Teva") to review the common specification of nine patents at issue in this lawsuit (the "Patents-in-Suit"), provide a tutorial of the technical and scientific concepts implicated by these patents, and prepare an expert declaration addressing the meaning of certain terms used in these patents. In rendering my opinions, I have reviewed the patents and their prosecution histories and the proposed constructions set forth by both Teva and Defendant Eli Lilly and Company ("Lilly") in the Joint Claim Construction Statement, as well as the materials set out in **Exhibit 2**.

II.   QUALIFICATIONS

2.   I am the Theresa and Eugene M. Lang Chair, Professor and Head of the Laboratory of Molecular Genetics and Immunology at The Rockefeller University. I joined the faculty of The Rockefeller University in 1996. Prior to that I was a member of the faculty of the Sloan-Kettering Institute of the Memorial Sloan-Kettering Center (1982-1996) where I was named a full Member in 1990.

3.   I received my Bachelor of Science degree in Molecular Biophysics and Biochemistry from Yale University in 1973. In 1978, I received my Ph.D. in Genetics from The Rockefeller University, and in 1979, I received my M.D. from Cornell Medical College. From 1979 to 1982, I worked as a post-doctoral researcher at the Laboratory of Molecular Genetics at the National Institutes of Health, Bethesda, Maryland where I cloned and characterized the genes for human immunoglobulin heavy chains.

4.   I have extensive experience in the fields of molecular biology and immunology. The Laboratory of Molecular Genetics and Immunology, which I direct at The Rockefeller

University, focuses its research on cellular and molecular mechanisms governing the generation of antibody specificity and the translation of that specificity into cellular responses. I am the author or co-author of over 200 scientific publications in the fields of molecular genetics and immunology, disciplines which build on the technologies of genetic engineering and cellular expression. I therefore have extensive knowledge of the key scientific and technological concepts relevant to the Patents-in-Suit, which are directed to therapeutic antibodies and their use for the treatment of migraine and other vasomotor conditions. These key concepts include genetic engineering, cellular expression, and antibody engineering.

5. I am a member of a number of professional organizations, including the American Association of Immunology, the American Association of Allergy and Immunology, the American Society for Biochemistry and Molecular Biology, and the American Society for Cell Biology, among others.

6. I am an Advisory Editor for the Journal of Experimental Medicine and a Transmitting Editor for International Immunology. I also serve on the Scientific Advisory Boards for several research organizations, philanthropic foundations, and corporations.

7. I have received many awards and honors for my research efforts in immunology, including the Pew Scholar Award, the Burroughs-Wellcome Award, the National Institutes of Health Merit Award, the Lee C. Howley Award, the AAI Huang Award for Meritorious Career, the Coley Award from the Cancer Research Institute, the Canada Gairdner International Award, the Sanofi-Pasteur Award, the Wolf Prize in Medicine, the Ross Prize, and the Robert Koch Prize. I was elected to the National Academy of Sciences of the United States in 2006, the Institute of Medicine in 2007, and the American Academy of Arts and Sciences in 2008. I am a frequent lecturer at numerous universities, medical centers, and international symposia.

8.   My experiences and qualifications are further detailed in my *curriculum vitae*, which is attached hereto as **Exhibit 1.**

III.   TECHNICAL BACKGROUND

9.   The nine Patents-in-Suit are generally directed to antibodies that bind to the protein Calcitonin Gene-Related Peptide ("CGRP") and the use of such antibodies to treat vasomotor diseases, such as migraine. Following is a tutorial on the background facts and scientific principles to assist the Court and explain the meaning of the disputed claim terms.

A.   Calcitonin-Gene Receptor Peptide ("CGRP")

10.   Calcitonin-Gene Receptor Peptide or "CGRP" is a small signaling protein made up of 37 amino acids. *See* '045 Patent at 1:25–27.[1,2] First identified in 1983, CGRP is widely distributed in the body and plays a key role in many cardiovascular and neurological processes, including vasodilation (the expansion of blood vessels). Humans have two main forms ("isoforms") of CGRP called α-CGRP and β-CGRP, which only differ in 3 of their 37 amino acids. *Id.* at 1:27–31. The primary biological function of CGRP is to seek out and bind to a separate protein called the CGRP receptor, which is located on the outer surface of certain cells. When CGRP binds to its receptor, the receptor activates a signaling pathway inside the cell that produces a downstream physiological response.

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[1] I understand that all of the Patents-in-Suit are part of the same family and share a common specification. For consistency, I have cited to the specification of the '045 Patent throughout my declaration. These citations are (apart from minor variations in line and column) equally applicable to the other eight Patents-in-Suit.

[2] I understand that this patent is attached to the concurrently-filed Declaration of Elaine Herrmann Blais in Support of Plaintiffs' Opening Claim Construction Brief ("Blais Declaration") as Exhibit A.

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