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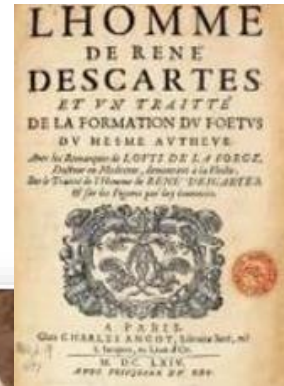
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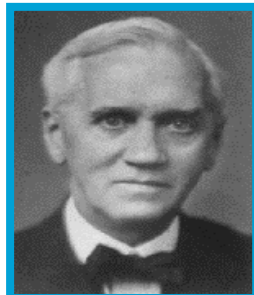
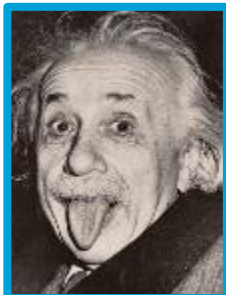
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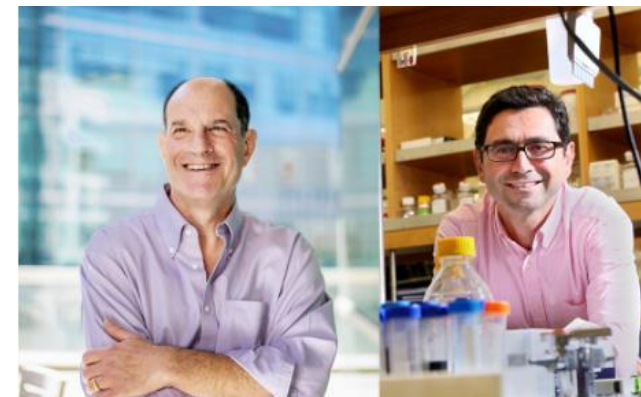
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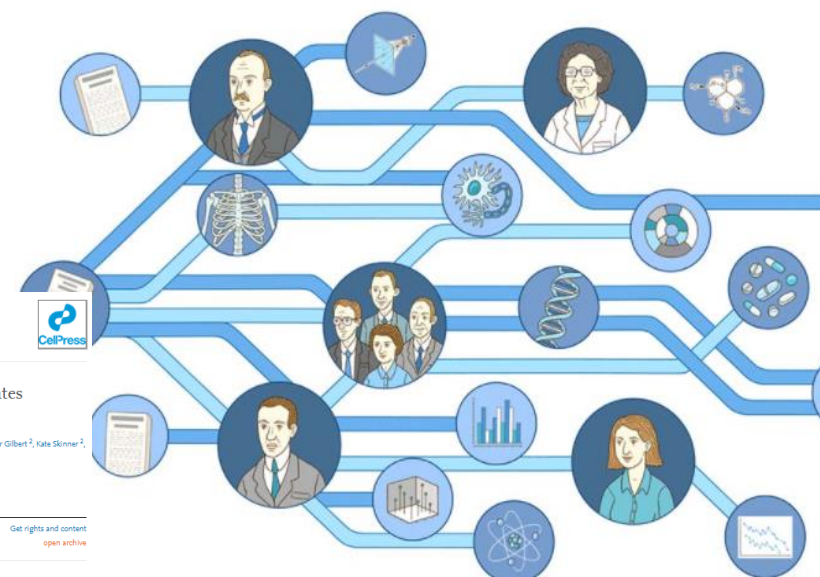
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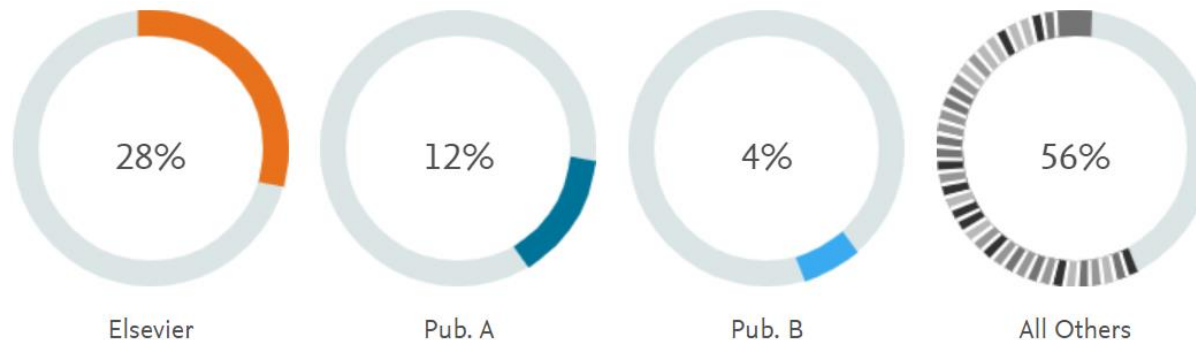
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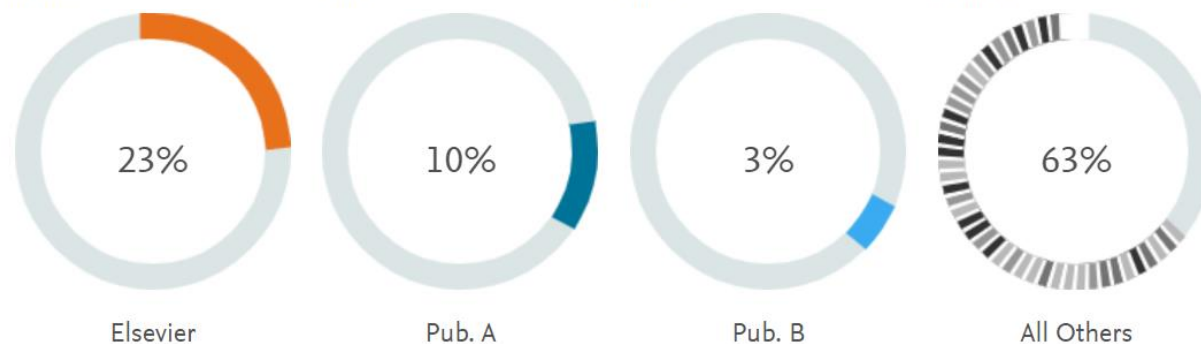
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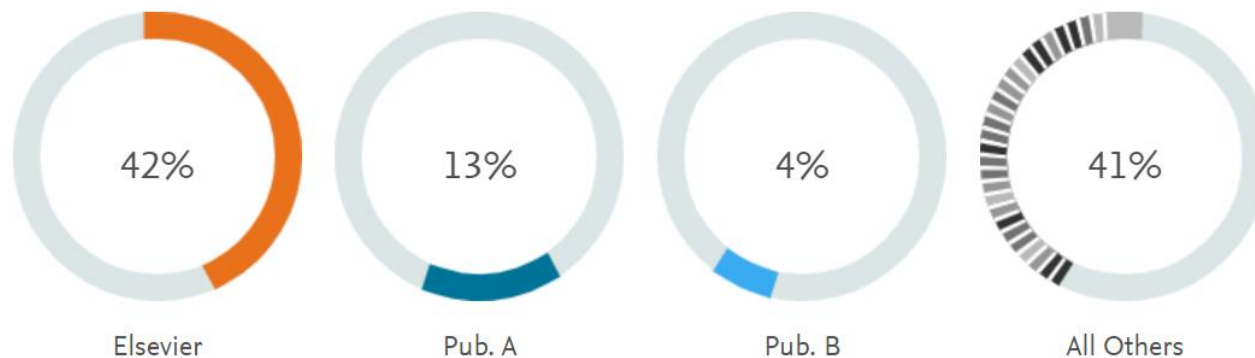
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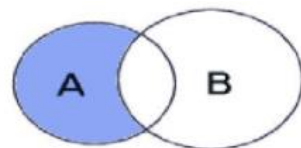
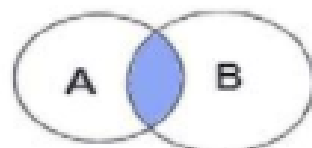
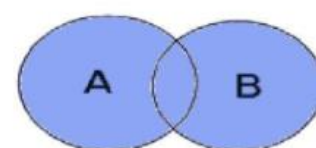
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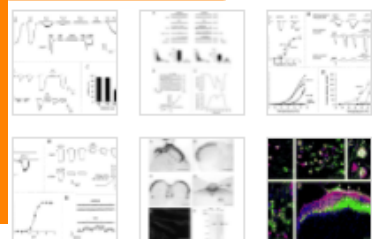
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Volume 21, Issue 3, September 1998, Pages 531-543

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Makoto Tominaga<sup>1</sup>, Michael J Caterina<sup>1</sup>, Annika B Malmberg<sup>2</sup>, Tobias A Rosen<sup>1</sup>, Heather Gilbert<sup>2</sup>, Kate Skinner<sup>2</sup>, Brigitte E Raumann<sup>1</sup>, Allan I Basbaum<sup>2</sup>, David Julius<sup>1,2,\*</sup>

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**Capsaicin**, the main pungent ingredient in “hot” chili peppers, elicits burning pain by activating specific (vanilloid) receptors on sensory nerve endings. The cloned vanilloid receptor (VR1) is a cation channel that is also activated by noxious heat. Here, analysis of heat-evoked single channel currents in excised membrane patches suggests that heat gates VR1 directly. We also show that protons decrease the temperature threshold for VR1 activation such that even moderately acidic conditions (pH ≤ 5.9) activate VR1 at room temperature. VR1 can therefore be viewed as a molecular integrator of chemical and physical stimuli that elicit pain. Immunocytochemical analysis indicates that the receptor is located in a neurochemically heterogeneous population of small diameter primary afferent fibers. A role for VR1 in injury-induced hypersensitivity at the level of the sensory neuron is presented.

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## Neuron

Volume 21, Issue 3, September 1998, Pages 531-543



Article

### The Cloned Capsaicin Receptor Integrates Multiple Pain-Producing Stimuli

Makoto Tominaga<sup>1</sup>, Michael J Caterina<sup>1</sup>, Annika B Malmberg<sup>2</sup>, Tobias A Rosen<sup>1</sup>, Heather Gilbert<sup>2</sup>, Kate Skinner<sup>2</sup>, Brigitte E Raumann<sup>1</sup>, Allan I Basbaum<sup>2</sup>, David Julius<sup>1</sup>✉

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Abstract

**Capsaicin** the main pungent ingredient in “hot” chili peppers, elicits burning pain by activating specific (vanilloid) receptors on sensory nerve endings. The cloned vanilloid receptor (VR1) is a cation channel that is also activated by noxious heat. Here, analysis of heat-evoked single channel currents in excised membrane patches suggests that heat gates VR1 directly. We also show that protons decrease the temperature threshold for VR1 activation such that even moderately acidic

#### Capsaicin

Capsaicin (Zostrix) is an alkaloid extract derived from hot chili peppers that is available as both cream and a lotion in strengths of 0.025% and 0.075%.

From: Current Therapy in Pain, 2009

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#### CAPSAICIN

M.G. Belvisi, D.J. Hele, in Encyclopedia of Respiratory Medicine, 2006

##### Localization of TRPV1

The capsaicin-sensitive vanilloid receptor is expressed mainly in sensory nerves including those emanating from the dorsal root ganglia and afferent fibers that innervate the airway, which originate from the vagal ganglia. In the dorsal root and trigeminal ganglion, TRPV1 is localized to small and medium-sized neurons. Somatic

#### Capsaicin

L. Charles Murrin, in xPharm: The Comprehensive Pharmacology Reference, 2007

##### Pre-Clinical Research

Administration of capsaicin to neonatal and adult animals has produced a wide range of effects and many discrepancies exist in the literature, see Gamse (1982). There also appear to be species differences. The data shown represent a sampling of the literature.

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## Neuron

Volume 21, Issue 3, September 1998, Pages 531-543



Article

## The Cloned Capsaicin Receptor Integrates Multiple Pain-Producing Stimuli

Makoto Tominaga<sup>1</sup>, Michael J Caterina<sup>1</sup>, Annika B Malmberg<sup>2</sup>, Tobias A Rosen<sup>1</sup>, Heather Gilbert<sup>2</sup>, Kate Skinner<sup>2</sup>, Brigitte E Raumann<sup>1</sup>, Allan I Basbaum<sup>2</sup>, David Julius<sup>1,2</sup>✉

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Capsaicin, the main pungent ingredient in “hot” chili peppers, elicits burning pain by activating specific (vanilloid) receptors on **sensory nerve endings**. The cloned vanilloid receptor (VR1) is a cation channel that is also activated by noxious heat. Here, analysis of heat-evoked single channel currents in excised membrane patches suggests that heat gates VR1 directly. We also show that protons decrease the temperature threshold for VR1 activation such that even moderately acidic

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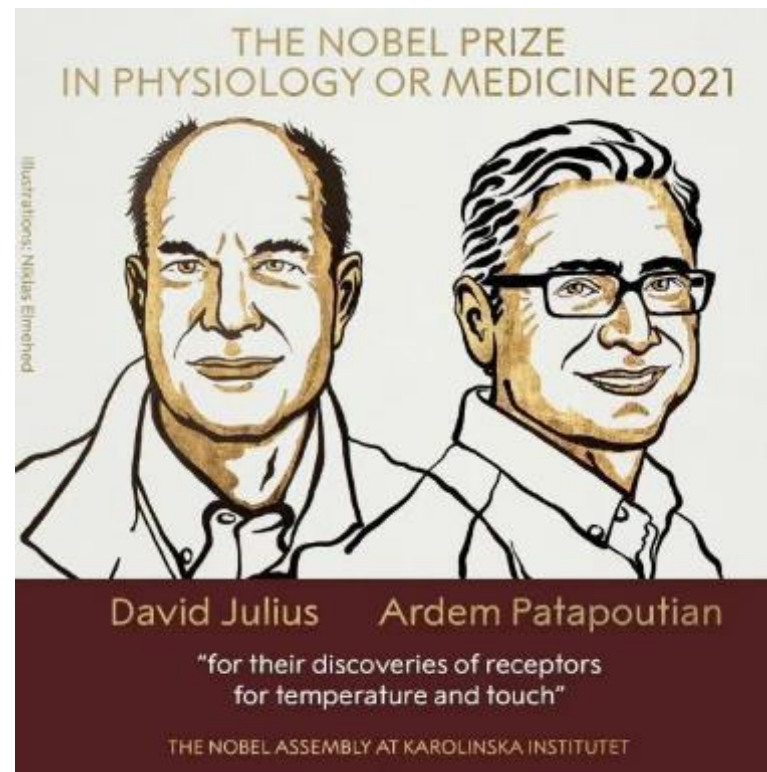
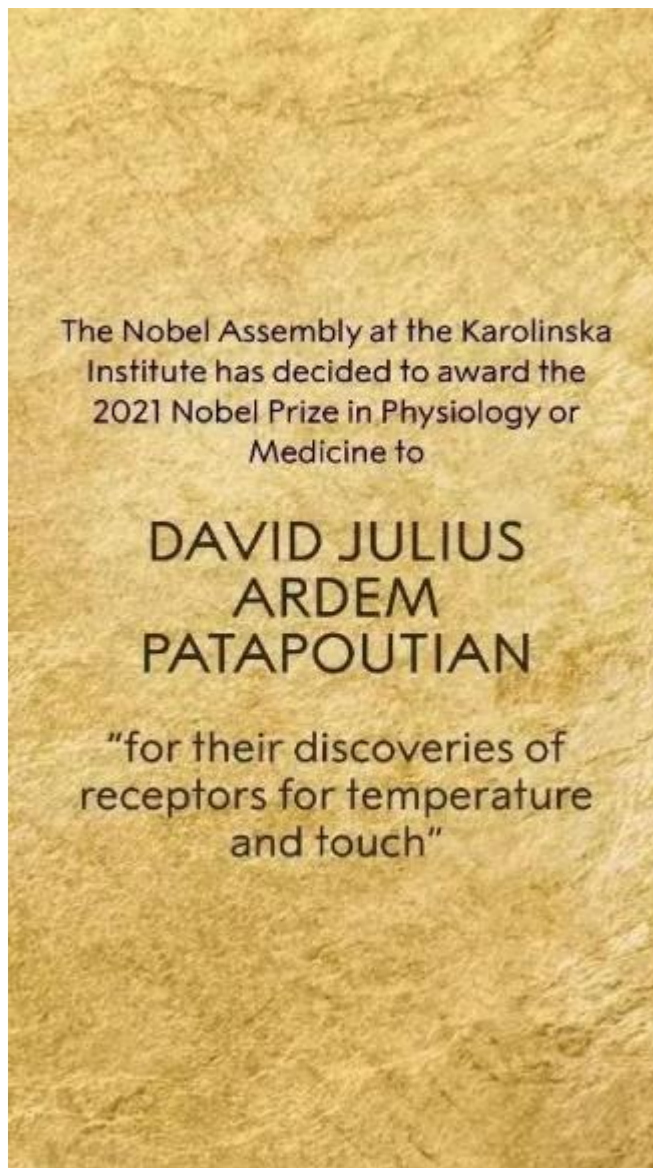
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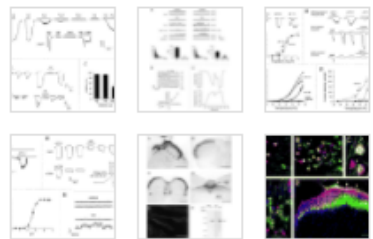


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# Neuron

Volume 21, Issue 3, September 1998, Pages 531-543



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## The Cloned Capsaicin Receptor Integrates Multiple Pain-Producing Stimuli

Makoto Tominaga<sup>1</sup>, Michael J Caterina<sup>1</sup>, Annika B Malmberg<sup>2</sup>, Tobias A Rosen<sup>1</sup>, Heather Gilbert<sup>2</sup>, Kate Skinner<sup>2</sup>, Brigitte E Raumann<sup>1</sup>, Allan I Basbaum<sup>2</sup>, David Julius<sup>1,2,3,4</sup>✉

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- 1988 - 1990 Vagelos College of Physicians and Surgeons, New York, United States
- 1988 - 1990 Howard Hughes Medical Institute, Chevy Chase, United States
- 1990 Stanford University Medical Center, Stanford, United States
- 1979 - 1984 University of California, Berkeley, Berkeley, United States

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Article

## Structural snapshots of TRPV1 reveal mechanism of polymodal functionality

Kaihua Zhang<sup>1</sup>, David Julius<sup>2,3</sup>, Yifan Cheng<sup>1,3,4,5</sup>

- <sup>1</sup> Department of Biochemistry and Biophysics, University of California, San Francisco, San Francisco, CA, USA
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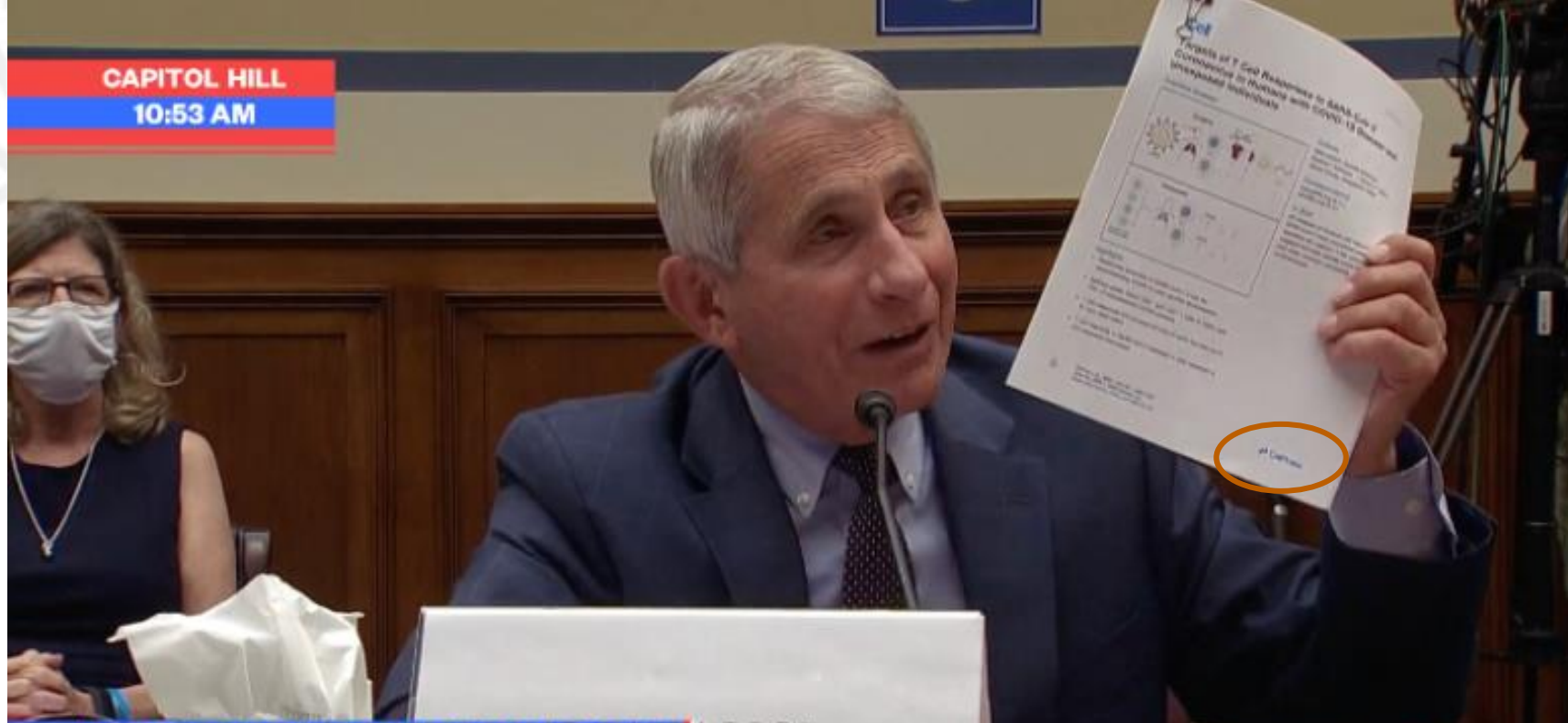
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