

Exhibit G

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA**

PEOPLE OF THE STATE OF CALIFORNIA,
et al.,
Plaintiffs,

v.

META PLATFORMS, INC, Instagram, LLC,
Meta Payments, Inc., Meta Platforms
Technologies, LLC., et al.,
Defendants

IN RE: SOCIAL MEDIA ADOLESCENT
ADDICTION/PERSONAL INJURY
PRODUCTS LIABILITY LITIGATION

THIS DOCUMENT RELATES TO:
4:23-cv-05448

MDL No. 3047

Case No. 4:23-cv-05448-YGR

Judge: Hon. Yvonne Gonzalez Rogers

Magistrate Judge: Hon. Peter H. Kang

**TRIAL REPORT OF
Mitch Prinstein, Ph.D.**

May 16, 2025

I. Introduction

I.A. Summary of opinions

- (1) **Youth (beginning ages 10 years until the mid-twenties) are hypersensitive to social feedback, automatic behaviors, and have underdeveloped impulse control. The features and functions embedded within Meta’s social media platforms exploit these vulnerabilities in potentially harmful ways.** Due to normative asynchronous development of brain regions, youth are biologically susceptible to cues related to social interaction, evaluation, and attention from peers but are not fully capable of regulating impulses to seek these cues excessively. This biological vulnerability makes youth especially susceptible to Meta platform features including the count of likes, followers, comments, and notifications.
- (2) **Meta platform features encourage problematic social media use, consistent with clinical dependency.** There is considerable overlap in the regions of the brain activated by social media use and those involved in addictions to illegal and dangerous substances. Research has demonstrated that many adolescents report an inability to stop using social media and display other tolerance, withdrawal, and impairment symptoms that overlap with diagnostic criteria for substance use dependencies.
- (3) **Problematic social media use, promoted by Meta platform features, interferes with adaptive relationship development skills and healthy peer socialization processes, posing a risk to adolescents’ mental health. Moreover, problematic social media use disrupts opportunities to engage in offline, healthy, necessary activities including sleep.** Insufficient sleep is associated with poor school performance, difficulties with attention and stress regulation, and increased risk for automobile accidents. Neuroscientific research has demonstrated that inconsistent sleep schedules are associated with deleterious changes in structural brain development in adolescent years.
- (4) **Social media platform features change the impact of harmful content and create stress that contributes to mental health symptoms.** Social media platforms such as Instagram serve two domains of problematic material to youth. One domain pertains to posts that actively showcase and promote engagement in psychologically disordered behavior, such as sites that discuss eating disordered behaviors. A second area of concern regarding online content pertains to the frequency of online discrimination and cyberbullying. Social media platforms’ design choices amplify the impact this content has on users, creating stress and contributing to mental health symptoms.

II. Background

II.A. The neuroscience of adolescent brain development as relevant to social media use

- (23) Developmental neuroscientists have identified two highly critical periods for adaptive neural development.⁶ As I explain in this section, disruptions to our brain growth during these periods may have significant implications.⁷ One of these is the first year of life. The second most substantial period of brain reorganization begins at the outset of puberty – about 1–2 years before pubertal changes are observable on the body - and lasts until early adulthood (i.e., from approximately 10 to 25 years old). This latter period is highly relevant for understanding the risks of social media,⁸ as this is when a great number of youths are offered relatively unfettered access to devices and unrestricted or unsupervised use of social media and other online platforms.⁹ As I discuss further below, neurological changes occur gradually and steadily within the age range of 10–25 years; thus, risks are likely greater towards the beginning of this range and become attenuated as the youth mature.¹⁰
- (24) Pubertal development within the brain generally affects one region at a time. This is important because it means that some areas of the brain are maturing and becoming sensitive to the environment in new ways, many years before other areas of the brain are able to be utilized in the capacity that we might expect among adults.¹¹ In broad terms, the brain first develops some of the lower (i.e., more “primitive”) functions that we tend to share with many mammalian species.¹² Years later, neural maturation occurs more substantially within some of the upper regions, referred to as the cerebral cortex. This brain geography is important. The regions of the brain that sit below the cerebral cortex

⁶ Adrienne L. Tierney and Charles A. Nelson III, “Brain development and the role of experience in the early years,” *Zero to Three* 30, no. 2 (2009): 9. Amy Orben, Andrew K. Przybylski, Sarah-Jayne Blakemore, and Rogier A. Kievit, “Windows of developmental sensitivity to social media,” *Nature Communications* 13, no. 1 (2022): 1649.

⁷ Charles A. Nelson and Laurel J. Gabard-Durnam, “Early adversity and critical periods: neurodevelopmental consequences of violating the expectable environment,” *Trends in Neurosciences* 43, no. 3 (2020): 133–143. “The Teenage Brain: Under Construction,” American College of Pediatricians, May 2022, <https://acpeds.org/position-statements/the-teenage-brain-under-construction>.

⁸ Amy Orben, Andrew K. Przybylski, Sarah-Jayne Blakemore, and Rogier A. Kievit, “Windows of developmental sensitivity to social media,” *Nature Communications* 13, no. 1 (2022): 1649.

⁹ Anne J. Maheux, Kaitlyn Burnell, Maria T. Maza, Kara A. Fox, Eva H. Telzer, and Mitchell J. Prinstein, “Annual Research Review: Adolescent Social Media Use Is Not a Monolith: Toward the Study of Specific Social Media Components and Individual Differences,” *Journal of Child Psychology and Psychiatry* 66, no. 4 (2025): 440–459.

¹⁰ Mitchell J. Prinstein and Matteo Giletta, “Future Directions in Peer Relations Research,” *Journal of Clinical Child & Adolescent Psychology* 49, no. 4 (2020): 556–572. Leah H. Somerville, “The Teenage Brain: Sensitivity to Social Evaluation,” *Current Directions in Psychological Science* 22, no. 2 (2013): 121–127.

¹¹ Jay N. Giedd, Jonathan Blumenthal, Neal O. Jeffries, F. Xavier Castellanos, Hong Liu, Alex Zijdenbos, Tomáš Paus, Alan C. Evans, and Judith L. Rapoport, “Brain Development During Childhood and Adolescence: A Longitudinal MRI Study,” *Nature Neuroscience* 2, no. 10 (1999): 861–863.

¹² Dustin Albert and Laurence Steinberg, “Judgment and decision making in adolescence,” *Journal of Research on Adolescence* 21, no. 1 (2011): 211–224. Leah H. Somerville, “The teenage brain: Sensitivity to social evaluation,” *Current Directions in Psychological Science* 22, no. 2 (2013): 121–127.

(i.e., “subcortical”) tend to be associated with behaviors that are outside of our conscious awareness. For instance, we do not think about our heart in order to keep it beating. Similarly, there are many tasks that we engage in simply out of habit or routine. In most cases, these are regulated by more primitive brain regions that mature first at the outset of puberty. In contrast, the cerebral cortex may be disproportionately responsible for our “consciousness,” meaning that brain activity within the cerebral cortex may be associated with us consciously choosing, deliberating, or recognizing some of our behavioral choices.¹³ As discussed in more detail below, several features and functions embedded within Meta social media platforms activate subcortical responses in the brain that lead to “automatic” behaviors among youth outside of their full conscious awareness. Others actively inhibit active engagement with cortical regions of the brain.

II.A.1. Youth hypersensitivity to social feedback and “automatic” behaviors

- (25) The developing brain is relevant to social media for two reasons. First is the tendency for adolescents to be hypersensitive to social feedback (and consequent “automatic” behaviors), and the second is that adolescents have underdeveloped impulse control. I discuss each in this and the next section, respectively.
- (26) One of the first regions of the brain that undergoes substantial reorganization at the outset of puberty is referred to as the ventral striatum. Starting around ages 10 or 11 for most youth, there is a rapid proliferation of neuronal receptors within this brain region for two substances that are related to our social experiences.¹⁴ One of these is oxytocin, which is generally associated with social bonding, especially with peers around our own age.¹⁵ The second is dopamine, which is associated with feelings of pleasure when we experience attention, feedback, and reinforcement, or gain power and influence among our peers.¹⁶ Many studies have reliably demonstrated the activation of regions rich with dopamine and oxytocin receptors during interactions with peers, including when attention is directed toward us.¹⁷ Some of these studies have specifically revealed these effects under conditions that mimic the experience of adolescent social media use.¹⁸ In short, this research suggests that

¹³ Laurence Steinberg, “A social neuroscience perspective on adolescent risk-taking,” *Biosocial Theories of Crime*, Routledge (2017): 435–463. Betty J. Casey, Sarah Getz, and Adriana Galvan, “The adolescent brain,” *Developmental Review* 28, no. 1 (2008): 62–77.

¹⁴ Ronald E. Dahl, Nicholas B. Allen, Linda Wilbrecht, and Ahna Ballonoff Suleiman, “A Developmental Science Perspective on Investing in Adolescence,” *Nature* 554, no. 7693 (2018): 441–450.

¹⁵ “Oxytocin,” Cleveland Clinic, accessed May 6, 2025, <https://my.clevelandclinic.org/health/articles/22618-oxytocin>.

¹⁶ “Dopamine,” Cleveland Clinic, accessed May 6, 2025, <https://my.clevelandclinic.org/health/articles/22581-dopamine>.

¹⁷ Allan Colver and Sarah Longwell, “New Understanding of Adolescent Brain Development: Relevance to Transitional Healthcare for Young People with Long Term Conditions,” *Archives of Disease in Childhood* 98, no. 11 (2013): 902–907. Wolfram Schultz, “Reward Signaling by Dopamine Neurons,” *The Neuroscientist* 7, no. 4 (2001): 293–302. Thomas R. Insel, and Russell D. Fernald, “How the Brain Processes Social Information: Searching for the Social Brain,” *Annual Review of Neuroscience* 27, no. 1 (2004): 697–722.

¹⁸ Eva H. Telzer and Maria T. Maza, “Social media and the developing brain,” In *Handbook of Media Psychology: The Science and The Practice*, pp. 33–43. Cham: Springer Nature Switzerland, 2024. Leah H. Somerville, “The teenage brain: Sensitivity to social evaluation,” *Current Directions in Psychological Science* 22, no. 2 (2013): 121–127.

children and pre-adolescents are likely to be hypersensitive to social cues beginning in the early stages of puberty, before changes to the body are visible externally. In other words, youth become especially invested in behaviors that will help them get personalized feedback, praise, or attention from peers.

- (27) Importantly, research suggests that the ventral striatum within the “social brain” also informs a nearby brain region called the ventral pallidum, which is part of our brain’s motivational network. In simple terms, the close proximity between these two areas of the brain may be designed to drive us to get more of what feels pleasurable.¹⁹ Recall that this all occurs in subcortical regions of the brain. In other words, something that makes us feel good, initiating a dopamine response, might lead to behaviors we engage in repeatedly, yet they do not involve conscious, deliberative decision-making (i.e., they are often Pavlovian or automatic responses). In the English language, we might refer to these behaviors as a habit, a craving, or an instinct because we sometimes seem to engage in these types of behaviors before we even realize that we are doing so. This is a process that is often used to explain the addictive characteristics of illegal substances because they involve the same regions of the brain and the same qualities of dopamine receptors.²⁰

II.A.2. Youth underdeveloped impulse control

- (28) Also highly relevant to the features embedded within Meta’s social media platforms is the delayed maturation of youths’ impulse control. This is due to the delayed maturation of cortical processes in the brain until the mid-twenties, which makes young people less capable of resisting impulses or stopping themselves from behavior that may lead to temporary benefit despite negative, longer-term consequences. This can lead to adolescents making decisions based on short-term gain, lower appreciation of long-term risks, and interference with focus on tasks that require concentration.²¹
- (29) In other words, one might think of the prefrontal cortex as the brain’s “brakes” that play an important role in stopping us from engaging in whatever behavior might give us temporary pleasure. Importantly, interventions that are designed to appeal to our conscious decision-making, our sense of rational behavior, or our desire to regulate our behavior are typically directed to increase activation of the prefrontal cortex.²² Since this area is not yet fully developed among adolescents

¹⁹ Kent C. Berridge, “From prediction error to incentive salience: mesolimbic computation of reward motivation,” *European Journal of Neuroscience* 35, no. 7 (2012): 1124–1143.

²⁰ Kent C. Berridge, “From prediction error to incentive salience: mesolimbic computation of reward motivation,” *European Journal of Neuroscience* 35, no. 7 (2012): 1124–1143.

²¹ Lisa J. Knoll, Lucía Magis-Weinberg, Maarten Speekenbrink, and Sarah-Jayne Blakemore, “Social influence on risk perception during adolescence,” *Psychological Science* 26, no. 5 (2015): 583–592.

²² Dustin Albert and Laurence Steinberg, “Judgment and decision making in adolescence,” *Journal of Research on Adolescence* 21, no. 1 (2011): 211–224.

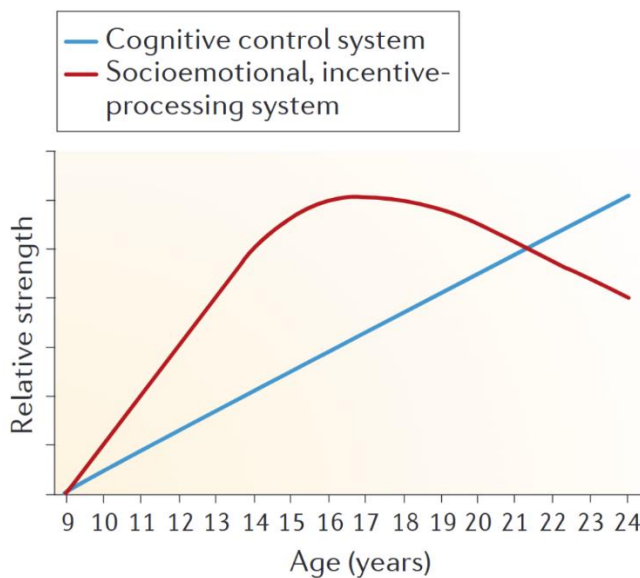
between the ages of 10 and 25 years old, those appeals to conscious decision-making are likely to be less successful.

- (30) In sum, at the outset of puberty, adolescents' brains begin developing in a specific, pre-determined sequence. Generally, sub-cortical areas shared with many mammalian species mature before areas at the top layer of the brain, which is responsible for many of our more human capabilities, such as premeditation, reflection, and inhibition. Among these initial areas developing among most youth, typically starting at the ages of 10–12, are regions associated with our craving for “social rewards,” such as visibility, attention, and positive feedback from peers. In contrast, regions involved in our ability to inhibit our behavior, and resist temptations (i.e., the prefrontal cortex) do not fully develop until early adulthood (i.e., approximately 10–15 years later). Between the ages of approximately 10 and 25, therefore, youth are biologically susceptible to (i.e., craving) cues related to social interaction, evaluation, and attention from peers, yet not fully capable of regulating impulses to seek these cues excessively.²³ Figure 1, excerpted from a review of this literature,²⁴ illustrates the discrepancy in the desire for social rewards (the socioemotional incentive-processing system depicted in red) in contrast to the ability to control impulses (the cognitive control system depicted in blue) across childhood, adolescence, and emerging adulthood. As depicted in the figure, the desire for social reward is stronger than the ability to control impulses between the ages of 9 and 21 (i.e., the red line is higher than the blue line), with social rewards particularly dominating from the ages of about 13 to 18 (i.e., the two lines have the largest gap).

²³ I note that Instagram's Head of Research testified, “Teens and actually up through—and some scholarly literature suggests that that happens up through the age of even like 25 to 28, but yes, and teens, roughly speaking, are still developing aspects of self-control. Not every teen. Obviously, there are differences between some teens.” Deposition of Kristin Hendrix, January 22, 2025, 278:14–25.

²⁴ Laurence Steinberg, “The influence of neuroscience on US Supreme Court decisions about adolescents' criminal culpability,” *Nature Reviews Neuroscience* 14, no. 7 (2013): 513–518.

Figure 1: The discrepancy in the desire for social rewards in contrast to the ability to control impulses across childhood, adolescence, and emerging adulthood



Source: Laurence Steinberg, “The influence of neuroscience on US Supreme Court decisions about adolescents’ criminal culpability,” *Nature Reviews Neuroscience* 14, no. 7 (2013): 513–518, p. 518.

- (31) To preview, the biological vulnerability created by the asynchronous development of these brain regions makes youth especially susceptible to several features embedded within Meta platforms.²⁵ These include social reward features that suggest users have gotten attention and feedback, resulting in a dopamine response, such as the count of likes, followers, comments, and notifications, which I discuss throughout this report.

II.B. The importance of sleep for adolescents’ brain development and mental health

- (32) As noted above, other than the first year of life, puberty is the most important period of brain growth and reorganization. Sleep in adolescence is essential for healthy brain development and mental health. Sleep delay or disruptions also have significant negative effects on youths’ attention, behavior, mood, stress regulation, safety, body shape, and academic performance.²⁶

²⁵ For a Meta-internal presentation on teen brain development, see META3047MDL-031-00191726, slides 7–12, 22–30, 46–49, 56–61, 69–75.

²⁶ “Potential risks of content, features, and functions: The science of how social media affects youth,” American Psychological Association, accessed April 25, 2025, <https://www.apa.org/topics/social-media-internet/youth-social-media-2024>. Aurore A. Perrault, Laurence Bayer, Mathias Peuvrier, Alia Afyouni, Paolo Ghisletta, Celine Brockmann, Mona Spiridon et al, “Reducing the use of screen electronic devices in the evening is associated with improved sleep