

## Award for Distinguished Scientific Contributions: Kent C. Berridge

The APA Awards for Distinguished Scientific Contributions are presented to persons who, in the opinion of the Committee on Scientific Awards, have made distinguished theoretical or empirical contributions to basic research in psychology. One of the 2016 award winners is Kent C. Berridge, who received this award for “outstanding contributions to the understanding of the psychological and neural basis of motivation.” Berridge’s award citation, biography, and a selected bibliography are presented here.

### Citation

“For outstanding contributions to the understanding of the psychological and neural basis of motivation, in particular through his studies of feeding. Kent C. Berridge has displayed imaginative insight in relating rodent behavior to hedonic ‘liking’ and motivational ‘wanting’ responses in humans. He also has greatly added to knowledge of the functions of dopamine and opioid systems in incentive salience and reward and, through collaborations with Terry E. Robinson, their possible relevance to drug addiction via mechanisms of incentive sensitization. His lucid scholarly writing and potent combination of sophisticated behavioral analysis and innovative neurobiological technique have been inspirational for his many students.”

### Biography

Kent Berridge grew up in the San Fernando Valley suburbs of Los Angeles, California. At age 15, in a high school biology class, Berridge wrote a book report on the evolution of human aggression. This assignment first sparked his interest in how brains could influence minds and psychological processes.

Berridge entered the University of California at Davis (UC Davis) in 1975. He did not know then that psychology included biological perspectives on the mind. He was simply lucky in his first term to enroll in the team-taught introductory psychology course that would open his eyes. The course began with a 10-week introductory module on biological psychology, taught by excellent comparative psychologists Bill Mason and Don Owings and talented behavioral neuroscientists Leo Chalupa and Ken Henry. Berridge was enthralled in each segment and decided during that first term that he would try to become a biological psychologist. This conviction further strengthened in subsequent terms at the UC Davis campus.

The University of California offered an option to study abroad during third year, and Berridge applied to study in England at the University of Sussex for 1977–1978. His year at Sussex was personally rewarding and intellectually formative. He took courses with notable faculty Richard Andrew, Nick Mackintosh, and Margaret Boden. Richard

Andrew’s neuroethology research lab particularly instigated Berridge’s ethological appreciation of close analyses of natural behavioral patterns as a potential window into psychological processes. An epiphany came after studying the effect of a brain manipulation on the behavior of newly hatched chicks one day, when Andrew tabulated Berridge’s score sheet and found in the record an important effect on the chicks’ attention and distraction that Berridge had entirely failed to perceive himself during the day—though it was recorded through his own eyes and hand. In Berridge’s later research, a focus on close video analyses of natural behavior patterns has been crucial to several findings, including revealing the difference between “liking” and “wanting” mechanisms, identifying pleasure-discovering hedonic hotspots in brain, and brain mechanisms that can flexibly generate either desire or dread.

After graduating from UC Davis, Berridge entered the psychology PhD program at the University of Pennsylvania (UPenn) in Philadelphia. The UPenn psychology department was a marvelous place to be a graduate student in the 1980s, filled with exciting faculty, including Harvey Grill, David Premack, Randy Gallistel, Rochel Gelman, Paul Rozin, Bob Rescorla, Marty Seligman, and other luminaries. An equally stimulating group of fellow Psychology graduate students, and lively interactions across the university with students and faculty in neuroscience departments, rounded out the experience. At UPenn, Berridge joined the laboratory of Harvey Grill, who took a neuroethological approach to brain mechanisms of motivation. Harvey had a wonderfully nurturing style of mentorship, which encouraged Kent and other graduate students to follow their own intellectual paths. Berridge was particularly intrigued by the taste reactivity technique that Grill had developed to measure taste-elicited affective facial expressions in rats, similar to emotional facial expressions of human infants that are elicited by pleasant versus nasty tastes. In his doctoral dissertation, Berridge applied this tool to a question that goes back in psychology at least to Wundt’s 19th-century model of emotion: namely, whether pleasure versus displeasure are organized as ends of one continuum (and are thus necessarily reciprocal) or instead are two independent di-



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mensions of evaluation (so that, in principle, both pleasure and disgust could occur simultaneously). Berridge's results supported the two-dimensional hypothesis, though he is no longer as convinced by his dissertation results as he was at the time.

After finishing his PhD at UPenn in 1983, Berridge began a 2-year postdoctoral fellowship at Dalhousie University in Nova Scotia in the laboratory of John Fentress. Psychological processes are always expressed through patterns of action for anyone in affective neuroscience studying motivation and emotion in animals. Therefore, a challenge is to correctly decipher the psychological processes through a reverse translation of action-to-motivation. Kent was attracted by John's sophisticated neuroethological approach to this translation problem. John's warm and generous nature, and excellent interactions with other Dalhousie denizens, helped ensure an enjoyable 2 years.

Berridge was very lucky in 1985 to start as assistant professor in the biopsychology program of the psychology department at the University of Michigan. This began a long and rewarding career at the University of Michigan, which has thus far extended over 30 years. The university's psychology department is large and diverse, with a positive sense of mutual interest and respect across the areas of psychology that helps provide a unifying atmosphere. Most important, the university has provided rich opportunities to interact with wonderfully outstanding colleagues and talented students. Berridge has been especially fortunate to collaborate over the years with colleagues, including Terry E. Robinson (with whom this APA award is shared), J. Wayne Aldridge, Elliot Valenstein, Phoebe Ellsworth, and

Robert Zajonc, as well as an excellent stream of highly talented PhD students and postdocs.

Around 1990, Berridge and Robinson collaborated on studies reporting that brain mechanisms for "wanting" a reward were different from those involved in "liking" the same reward, which originated from a surprise finding in what first appeared to be a failed experiment. In the 1980s, many believed that pleasure was essentially mediated in the brain by the neurotransmitter dopamine. Berridge and Robinson were therefore surprised to find that rats showed normal liking reactions to sweetness after nearly complete neurochemical removal of brain mesolimbic dopamine. However, dopamine loss abolished all wanting for sweetness as well as for all other rewards. With Elliot Valenstein a year later, Berridge conversely found that electrode stimulation of this mesolimbic brain reward system made rats voraciously want to eat but failed to increase their liking for what they ate. A series of follow-up studies bolstered the emerging idea that dopamine systems mediated wanting but not liking for rewards and helped identify psychological features of this form of wanting (incentive salience).

Building on the dopamine-as-wanting idea, Robinson and Berridge first proposed the incentive-sensitization theory of addiction in a theoretical review article in 1993. This theory also drew on Robinson's findings that addictive drugs could render dopamine systems hyperreactive or sensitized in vulnerable individuals. Applying dopamine sensitization and wanting ideas to addicts, the research pair found that neural sensitization could make such individuals develop intense addictive wanting, even if liking declined. Once induced, incentive-sensitization may persist for years after drug-taking has stopped.

It was rather a lonely scientific position throughout the 1990s to argue that dopamine caused only wanting, not liking, for rewards. But gradually that idea began to gain other adherents. Support came first from other animal studies and eventually about a decade later from human studies too. Recent evidence now suggests that similar mesolimbic wanting sensitization may develop relatively spontaneously in some other forms of addiction, giving the incentive-sensitization hypothesis a wider range of potential applications than originally envisioned (e.g., binge eating, compulsive gambling). The liking-wanting distinction has also been applied to disorders ranging from schizophrenia to depression, and philosophers and economists have occasionally discussed its implications for other fields.

In Berridge's lab, the idea that dopamine mediated wanting naturally prompted the next question: What in the brain really did cause pleasure liking? Results in the past decade have revealed a network of tiny, interactive hedonic hotspots in the brain able to cause or intensify pleasure when neurobiologically stimulated (e.g., by natural brain opioid or cannabinoid neurotransmitters). The pleasure question also led Berridge to collaborate with Morten Kringelbach at

Oxford University, a leader in human neuroimaging studies, in an effort to integrate affective neuroscience perspectives from human and animal studies into a more complete picture of how pleasure arises in brains. Other related questions pursued by students and colleagues in Berridge's lab in recent years have included what controls the directional target and narrowness of focus of intense addictive wants, how reward learning relates to liking and wanting, how desire relates to fear, and whether pleasure or emotion can ever be truly unconscious (the last with Piotr Winkielman). In all these, Berridge's guiding hope has been to gain insights into the psychology of these processes, as well as into their brain mechanisms.

Berridge believes that psychology's subfields have grown intellectually closer together over the course of his career and that psychology also now has stronger interactions with other neighboring disciplines. Or perhaps it has just taken him a while to notice these positive developments. Either way, he thinks the trend toward consilience is encouraging, facilitating a deeper understanding of mind and brain that can integrate across many levels. He has a sense that significant progress has been made and exciting prospects are in the future. All this makes Berridge grateful to have participated in the current era of psychology and neuroscience.

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