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A theory of natural addiction

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Abstract

Economic theories of rational addiction aim to describe consumer behavior in the presence of habit-forming goods. We provide a biological foundation for this body of work by formally specifying conditions under which it is *optimal* to form a habit. We demonstrate the empirical validity of our thesis with an in-depth review and synthesis of the biomedical literature concerning the action of opiates in the mammalian brain and their effects on behavior. Our results lend credence to many of the unconventional behavioral assumptions employed by theories of rational addiction, including adjacent complementarity and the importance of cues, attention, and self-control in determining the behavior of addicts. We offer evidence for the special case of the opiates that "harmful" addiction is the manifestation of a mismatch between behavioral algorithms encoded in the human genome and the expanded menu of choices faced by consumers in the modern world.

JEL classification: C73; D11; D83; D91; I12

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1. Introduction

The immature seed pod of *papaver somniferum*[1] contains a bitter, milky sap. Even in this, its most natural form, opium is a powerful drug, a stimulant narcotic poison that can induce hallucinations, profound sleep, or death. Reduced to its most sought-after chemical constituent,

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[1] Commonly known as the opium poppy.

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morphine, or further processed into heroin, opium is highly addictive and can have dramatic effects on the behavior, health, and well-being of its users. Opium's natural and synthetic derivatives (collectively known as the *opiates*) have well-known effects on human physiology and behavior: once they make their way into the bloodstream, opiates reliably induce a state of euphoria and pain relief, often followed by an increase in food consumption (Morley et al., 1985; Gosnell and Levine, 1996; McKim, 2002). Many who experience this state of mind find it pleasurable, and are inclined to try it again. But chronic use of opiates can result in severely impaired health,[2] and desperate addicts sometimes resort to theft or prostitution to obtain money to sustain the habit (National Institute on Drug Abuse, 2000). Given the potentially lamentable personal and social consequences of drug addiction (and the undeniable fact that legal restrictions have not been fully effective in eliminating drugs like heroin from the streets), many would agree that modern society would be much improved if our species could somehow rid itself of this particular human weakness.

Though the effects of opiates have been known to man for more than five millennia (Booth, 1996), only in recent decades has modern science made clear that opiate-like substances are also produced naturally in the bodies of humans and other animals. These substances are known collectively as the *endogenous opioids* and, like their poppy-derived counterparts, they have been shown to induce euphoria, pain relief, and appetite stimulation (van Ree et al., 1976; Yeomans and Gray, 1996; Mercer and Holder, 1997; Bodnar and Hadjimarkou, 2002).

The similarity of opiates and the endogenous opioids might seem something of a curiosity at first blush. Given the dramatic negative effects of opiates, what business do our bodies have producing their chemical cousins? There are, fortunately, many ways to answer this question, as the scientific literature is now replete with evidence demonstrating the circumstances under which our bodies produce endogenous opioids, the distribution of and variation in the endogenous opioid system across species, speculation about their evolutionary origins, and even confirmation that the biochemical "recipe" for endogenous opioids is firmly—and apparently universally—encoded in the human genome. This essay will attempt to identify circumstances under which a tendency to become "addicted" might serve a useful function, review supporting evidence from the biomedical literature, and ask what our findings might tell us about drug addiction. In other words, we will develop a theory of natural addiction.

2. Background

2.1. Rational addiction

A major source of inspiration for this investigation, and therefore a reasonable starting point for this essay, has been the rich body of theoretical and empirical work on addiction within the economics literature. This literature of *rational addiction* employs the formal mathematical tools of the economist in modeling addiction as a well-defined decision problem to be solved by an optimizing consumer. This approach allows for—and indeed, to some extent requires—the precise statement of the properties of the decision environment that generate addiction. It also

[2] The medical complications of chronic heroin use, for example, can include fetal death, scarred and/or collapsed veins, bacterial infections of the blood vessels and heart valves, abscesses (boils) and other soft tissue infections, disease of the liver or kidney, pneumonia, and tuberculosis. Death from overdose is not uncommon (National Institute on Drug Abuse, 2000).