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Of Drugs and Droogs: Cultural Dynamics, Psychopharmacology, and Neuroscience in Anthony Burgess's *A Clockwork Orange*

Lorenzo Servitje

In Britain around 1960 respectable people began to murmur about the growth of juvenile delinquency and read in certain sensational articles in certain newspapers that the young criminals . . . were somehow an inhuman breed and required inhuman treatment. There were irresponsible people who spoke of aversion therapy . . . if the young delinquents could be with the aid of electric shocks, *drugs*, or purely Pavlovian conditioning, rendered incapable of performing antisocial acts, then our streets would once more be safe at night.

—Anthony Burgess, 1985¹

Anthony Burgess's *A Clockwork Orange* is one of the most memorable and well-known British texts about youth counterculture. The novel, however, is rarely read in terms of its relevance to and representation of neuroscience. We are probably all familiar with the iconic scene from both the book and the 1972 Stanley Kubrick film adaptation in which young Alex, strapped to the chair, wires running from an electrode cap on his head, eyes held open with ocular restraints, is forced to watch an ultra-violent horror show until nausea and physical distress ensue. This scene reveals much more, however, than the oft-cited Pavlovian conditioning or the incorrect framing of the treatment as "brainwashing." What Burgess calls the "Ludovico treatment" is a neurological

intervention that uses behavioral conditioning and psychopharmacology to prevent unruly subjects from committing violent crime. The text's use of psychoactive drugs in youth counterculture in conversation with the state's medical intervention for the purposes of behavior control offers an opportunity to develop a neuroscientific reading of *A Clockwork Orange*. Such a reading not only speaks to the development of psychopharmacology as a discourse between dominant culture and counterculture, but also reveals neuroscience's cultural effects after World War II: specifically, the counterculture's use of psychoactive research for its own ends and the subsequent reactionary politics of a fear-based, disciplinary neuroscience. In effect, the novel demonstrates how neuroscience became a re-appropriation of a re-appropriation.

Critics have tended to explicate the behavioral modification deployed in the novel without speculating on the pharmaceutical agent used and its pharmacodynamic effects on Alex. However, psychopharmacology plays a central role in the novel's plot, generating a crucial neuroscientific discourse which the novel both illustrates and comments on. With respect to Alex's medical treatment, beyond clarifying that the Ludovico technique's mechanism of action is not brainwashing in the strict sense of the term, there has not been a significant amount of investigation into the treatment itself as a psychopharmacologic or neuroscientific technology.² Furthermore, while there has been some speculation on the drugs in the novel and what they might connote, the majority of scholarship has ignored this question.³ Most critics have focused either on Burgess's linguistic crafting of Nadsat, the invented dialect spoken in the novel, or on the ethics of the state-imposed medical treatment of Alex. These approaches are not without merit, of course, and they actually prove helpful when analyzing the place of neuroscience and the function of drugs in the novel.⁴

In this essay, I explore the specific drugs that appear in *A Clockwork Orange*, what their extant correlatives might be, and how they function within the novel's plot and themes. Alex and his *banda* use drugs as a form of "semiotic guerilla warfare," homologically synthesizing their performance as an ironic perversion of the intended disciplining and martial enhancement uses of the drugs represented in the text.⁵ Dominant culture ultimately subjects him to its purposive use of psychopharmacology with devastating consequences. This suggests that the novel has concerns beyond youth rebellion, state apparatuses, and abstract theorizations about free will and behavioral determinism. Considering that the 1950s and 1960s were pivotal decades for the development of neuroscience, *A Clockwork Orange's* publication in 1962

made it ripe for inflection by medical discourse surrounding the brain. I therefore argue that the novel reflects on the very question of how medicine, and specifically the dynamics among psychopharmacology, neuroscience, and psychiatry, functions within Western culture to mediate between mainstream culture and counterculture. I read this mediation as a way to identify a specific, critical biopolitical shift in thinking about regulating the brain and the consequences of such regulation for constituting normal and deviant subjectivities.

Psychopharmacology and the Neuroscience of Aversion in the "Long 1960s"

The historical context of *A Clockwork Orange* is a decisively neuroscientific and psychopharmacologic one. Although we don't have a list of source texts for his novel, we know that Burgess had been reading and writing in the dystopic tradition of George Orwell and Aldous Huxley. Burgess was specifically interested in *Brave New World* (1932) as Huxley was writing against the utopianism of H. G. Wells, a proponent of scientific rationalism.⁶ It is unclear whether Burgess had read B. F. Skinner's *Science and Human Behavior* (1953), a pivotal text in the zeitgeist of behavioral conditioning and modification during the midcentury, but there is evidence that Burgess at least found a summary of Skinner's text in Huxley's *Brave New World Revisited*.⁷ Burgess writes about Skinner's work being published at the same time as *A Clockwork Orange*, and he explicitly denounces it on mostly theological grounds.⁸ He also comments on the mechanism of subjection in *Brave New World*: "submissive docility that powerful states seek . . . [is] more easily obtainable through non-aversive means."⁹ Recalling that an integral part of the World State regime in Huxley's novel is achieved through a pharmacologic agent, we can see Burgess writing against the same kind of technocratic framework: better subjects through chemistry.¹⁰

While it was not until the end of the twentieth century that George H. W. Bush named the 1990s "the decade of the brain," the 1950s and the 1960s also marked a significant period for neuroscience, giving Burgess's novel a rich historical context for investigation. Although the word *neuroscience* does not appear in biomedical usage until 1962, its multidisciplinary foundations converged to form what we today conceive of as neuroscience during the mid-1950s and 1960s.¹¹ This closely parallels the period of what literary and cultural studies

scholars have called the “long 1960s.”¹² Nikolas Rose and Joelle Abi-Rached conceptualize this moment as a reformulation of the Foucauldian medical gaze. They suggest that the “neuromolecular gaze” begins with early nineteenth-century theories of neurochemistry and cerebral localization and then takes its modern form after the early 1960s as a new way of “seeing the brain” and conceptualizing the self.¹³ The development of a number of medical technologies allowed for a visualization of the brain: for example, the electroencephalogram (EEG), a technology I argue is part of the Ludovico treatment in Burgess’s novel, was developed in 1924 and brought to England a decade later, finally allowing clinicians and scientists to see the brain functioning in real time and to gauge responses to stimuli.¹⁴

The 1950s saw the introduction of research surrounding psychotherapeutic agents and their influence on neurotransmitters, most notably the use of chlorpromazine (Thorazine) as an antipsychotic used to treat schizophrenia and psychosis. While psychoactive drugs have been used for centuries, chlorpromazine arguably marks the beginning of psychopharmacology as a formalized discipline.¹⁵ Developed in 1952 and approved for use toward the end of the decade, it allowed behavioral and psychological conditions that were once under the purview of psychoanalysis and other non-materialist psychological science to become materialized under the rubrics of psychiatry and neurology.¹⁶ Unlike earlier treatments that required invasive surgical procedures, modern treatments were chemical. In 1965, Joseph J. Schildkraut published a landmark paper on the catecholamine hypothesis of affective disorders in the *American Journal of Psychiatry*. He suggested that then-recent work on the neurochemistry of psychiatric conditions was not just about neurotransmitters but about the “notion that pharmacology can become a bridge linking neuroscience and clinical psychiatry.”¹⁷ This had specific effects in terms of neurotransmitters and the development of drugs that act on them, but, more importantly, at this moment neuroscience was linked to the self-regulated normalization of behavior through psychopharmacological agents.

The deployment of chlorpromazine and Burgess’s writing of *A Clockwork Orange* intersect at a point in time when the institution of psychiatry was being reconceived. Chlorpromazine allowed the removal of physical restraints for many of the patients previously deemed to be dangers to themselves or others, a symbolic gesture similar to Philippe Pinel’s liberating the insane from the chains of Bicêtre in 1778.¹⁸ In addition, the drug’s development was coterminous with the decline of the physical containment model of mental illness which aligned

psychiatric hospitalization with penal incarceration, a decline evident in Burgess's novel in the shift from Alex the prisoner to Alex the patient. The reduction in use of physical restraints has a synecdochal relationship to the asylum at large and the movement to abolish the concept of Victorian-style brick and mortar asylums as the focal site of state mental health. The deployment of psychopharmacology was a crucial moment politically, especially for Britain, because it coincided with deinstitutionalization, the movement that began in Britain in the late 1950s and sought to dismantle the system of incarcerating the mentally ill, except in the most extreme of cases. In 1961 Enoch Powell, a well-known Member of Parliament, gave his famous "water tower speech" in favor of the dissolution of asylums; the following year the Hospital Plan for England and Wales predicted that by 1972 half of all British asylums would be closed.¹⁹ Psychiatrists and state health officials became free to release patients from the chains of the asylum and into the "supportive" atmosphere of community hospitals. This was praised politically and medically, but it incurred other problems. In effect, the asylum became the pill bottle; patients internalized restraints and normalizations by means of what Thomas Szasz, writing in 1957, characterized as "chemical straitjackets."²⁰ The freeing of patients from their physical restraints and confinements contextualizes the state's imperative to "cure" Alex and free him from the prison in order for him to rejoin society as a disciplined, productive subject—a notion I examine closely in the section on the Ludovico treatment.

The popular use of medication for aversion therapy to alter mental and behavioral deviations just before and during the long 1960s parallels the use of a pharmaceutical for the Ludovico treatment. The midcentury saw the introduction of a medication that very closely resembles Ludovico: disulfiram, discovered and synthesized in 1948 and marketed under the name Antabuse. In use in Britain by 1959, it was indicated for chronic alcoholics who were unsuccessful with traditional courses of treatment.²¹ Disulfiram works to instill severe nausea, vomiting, flushing, and anxiety whenever a patient ingests alcohol. In effect, it reverses the anxiolytic, anodyne, or euphoric effect that alcohol normally provides.²² The pharmacological treatment of alcoholism, affecting motivation and desire, demonstrates the historical linkage between psychological behaviorism, psychiatry, and pharmacology. Knowledge of disulfiram's impact was not solely circumscribed to a small community of psychiatrists. During an era that was flooded by fears and stories of Korean brainwashing, we find evidence that the public was informed of these types of behavior modification in a more

positive light.²³ With respect to disulfiram, in 1948, *Time* magazine ran an article on the drug entitled “Drug for Drunks” that enthusiastically describes the drug’s development by Erik Jacobsen and its potential to change lives.²⁴

Apomorphine proves to be the aversive agent most closely associated with Burgess, by way of American author William Burroughs. The knowledge of this treatment modality was circulating within the larger discourses of behavior modification and neuroscience during the period when Burgess was writing the novel. First synthesized in 1845, it became popular for treating opiate and alcohol addictions—in addition to homosexuality—after the Second World War. Apomorphine is not a narcotic. Quite the opposite, the drug functions by acting on the chemo trigger zone of the brain to induce nausea, vomiting, and general discomfort.²⁵ Patients receiving these treatments describe experiences strikingly similar to the Ludovico cure: “I can still taste the vile taste of stale sick in my mouth. . . . [I]t was like a barbaric torture scene by the Gestapo in Nazi Germany trying to extract information from me—I thought I was going to die.”²⁶ English psychiatrist John Yerbury Dent became one of the treatment’s most renowned practitioners, perhaps most well-known for treating Burroughs. Near the end of *Naked Lunch* (1959), Burroughs praises apomorphine for curing his addiction to heroin after he went to London to seek treatment from Dent. He remarks that “research with variations of apomorphine and synthesis of it will open a new medical frontier extending far beyond the problem of addiction.”²⁷ Although Burroughs and Burgess were not to meet until a year after *A Clockwork Orange*’s publication, Burroughs’s novel’s 1959 publication with the infamous Olympia Press was sure to have influenced writers in both popular and countercultural circles.²⁸ The connection between Burroughs’s apologia for apomorphine and Alex’s experience with Ludovico coincide insofar as they both refer to their specific treatments with the same biomedical metaphor. Burroughs writes “The vaccine that can relegate the junk virus to a land-locked past is in existence. This vaccine is the apomorphine treatment discovered by an English doctor whose name I must withhold pending his permission to use it and to quote from his book covering thirty years of apomorphine treatment of addicts and alcoholics. . . . I found this vaccine at the end of the junk line.”²⁹ In *A Clockwork Orange*, Alex refers to the treatment in similar terms: “this Ludovico stuff was like a vaccine and there it was cruising about my krovvy” (78). In contrast to Burroughs, Burgess’s rhetoric with respect to neuroscientific behavioral conditioning is far from celebratory.

Contemporaneous with Burgess's novel was a resistance against the growing deployment of neuroscience as a way to define, expand, and normalize deviant behaviors and personality types. Alex's narrative, then, could be contextualized through the primarily British Anti-Psychiatry movement, which emerged between the 1960s and the 1970s.³⁰ In addition to Thomas Szasz, R. D. Laing, a leading figure in the movement and a psychiatrist who was Burgess's contemporary, spoke out against psychiatric control and normalization in *The Divided Self* (1960), suggesting that it inhibited "the potentialities of the self," a notion that would later influence his use of hallucinogens.³¹ Considering this, in addition to the birth of psychopharmacology, pharmaceutical aversion therapy, and Burgess's own denunciation of Skinner's behaviorism, we can see *A Clockwork Orange* emerging from a matrix of correlative and competing neuroscientific discourses. While biomedicine was attempting to normalize minds, counterculture was using its own pharmacology to produce alternate consciousnesses and subjectivities. This is why drugs are so central to *A Clockwork Orange*.

Youth in Neurochemical Revolt

In the novel, drugs are not fictional additions or simply part of Burgess's linguistic play; each one carries a specific use and pharmacodynamics that signal its sturdy connection to real-world analogues. An investigation of the drugs identifies various modes of subversion and rebellion by Alex and his "droogs." Two critics speak to the youth culture's recreational drug use in the novel. Robert Evans addresses the specific names of the drugs Alex and his gang use. According to Evans, the three drugs mentioned in the beginning of the novel—*vellocet*, *synthemesc*, and *drencrom*—are all "purely imaginative" LSD-type hallucinogens.³² Andrew Biswell identifies *vellocet* with amphetamine and *synthemesc* with mescaline, a hallucinogenic peyote derivative.³³ I build on Biswell's and Evans's identifications when exploring the implications of each of these specific drugs as they pertain to counterculture's and dominant culture's uses of psychopharmacology in the novel.

In the opening scene of the novel, Burgess paints an immersive presentation of Alex's "droog" subculture, presenting the essential components of the droog *bricolage*: fashion, slang, and drugs. Alex situates his narrative with a description of the Korova Milkbar, where he and his gang prepare for their evening exploits by taking drugs in a unique route of administration. This short section contains allusions

to historical psychopharmacologic discourse that are occluded by the linguistic craft of Nadsat. In the very first paragraph, Alex educates his readers on the iconic milk bar: "The Korova Milkbar was a milk-plus mesto . . . what they sold there was milk plus something else . . . you could peet it with vellocet or synthemesc or drenchrom."³⁴ We would perhaps expect that these agents would lace some alcoholic drink, thereby heightening or modifying the effect of ethanol, a substance that the dominant culture already uses as an "approved" anxiolytic, anodyne, or recreational drug. Within the domain of traditional, dominant culture, milk connotes the unadulterated nourishment of children. Thus, Alex and his droogs make psychopharmacology their own by contaminating a symbol of fostering "healthy" youth, a notion that becomes clear through the pseudonyms the droogs use for drugs: "Milk plus knives," to name one example. Because linguistic play is a central theme and novelistic technique in *A Clockwork Orange*, it is necessary for any study concerning itself with the novel's countercultural significance to address it. Therefore, a brief analysis of the drug names is useful.

While hallucinogens play a sizeable role in the droog drug cocktail, stimulants—specifically amphetamines—prove to be the clearest and most developed example of the droogs' countercultural use of biomedical technology. For instance, amphetamine and mescaline become *vellocet* and *synthemesc*, respectively, through a morphologic alteration. As so much of Alex's lexicon is onomatopoeic, we can use this logic to trace the change. Considering *vellocet's* homonymic proximity to *velocity*, it makes sense that it refers to amphetamine, or "speed." *Synthemesc*, on the other hand, has a less poetic etymology. While I agree with Biswell that it refers to mescaline, it is important to pay attention to the *synth* morpheme, which suggests that the drug is not the naturally occurring alkaloid found in peyote but rather a synthetic derivative made in a lab. Its synthetic morpheme links it to its origin in biomedicine, a part of hegemonic and dominant culture that sought to explore the psychoactive as a treatment for schizophrenia. Like *synthemesc*, *drenchrom* also connotes a hallucinogen—adrenochrome—that originated within the biomedical establishment. Adrenochrome was discovered to be a mood-altering chemical during neuropsychiatric research into the neurochemistry of schizophrenia in 1952.³⁵ This historical correlative to the fictional *drenchrom* is not merely interesting, contextual psychopharmacological minutiae; the framing of these drugs within the biomedical discourse of their origin provides an understanding of how these drugs function within droog counterculture.

Amphetamines are a central component of the droog *bricolage* as they function to heighten the droogs' countercultural activities. It is well documented that Burgess took inspiration from the infamous "Teddy Boys" of the 1950s; Daniel Costello, citing an interview with Burgess in *Rolling Stone*, writes that "The droogs were some version of the Teddy Boys or greasers or hipsters projected into the future."³⁶ First, the connection between the fictional droogs and the historical Teddy Boys is a significant detail for my discussion, as the Teddy Boys have been linked to "heavy recreational use" of amphetamines, which most certainly contributed to the media moral panic surrounding them.³⁷ Second, amphetamines are the first drugs that Alex describes using. In addition to the three drugs discussed above, Alex refers to another psychotropic without giving it a Nadsat identifier, the way that he does for the other three. Alex tells his readers that in addition to milk plus, one "could peet milk with knives in it as we used to say" (3). The additive in this case, the previously mentioned "knives," also connotes a form of stimulant: milk plus knives "would sharpen you up and make you ready for a bit of the dirty twenty-to-one" (3). Considering the connotations of the name "knives," the pharmacodynamic effect of "sharpening," and the hyperbolic fight-enhancing "twenty-to-one" qualifier, the implication is that this psychoactive agent is a stimulant.

Taking into account the cultural role of psychopharmacology in both dominant and counter culture, I would suggest that Burgess hijacks psychoactive pharmaceuticals from the mental health field of his time and redploys them as performance enhancers for the droogs, giving them an edge in their ultra-violence. This use is a far cry from the disciplining function of psychiatric power, where stimulants serve as treatments for neuroses, depression, anhedonia, or chronic fatigue. Such medications were originally used to treat conditions that pertained specifically to problems of affect and to "normal" and efficient functioning. These original treatment modalities can be linked back to how *synthemesc* and *drencrom* were both discovered during psychiatric research. Psychotropic discipline and normalization, however, is only half of the story of dominant culture's use of psychopharmacology to sustain and propagate its system and structure, for Alex is also recuperated back into dominant culture through a psychiatric and neuroscientific modality.

While the aforementioned drugs' uses in psychiatry—normalizing depressive and low-functioning states—were their primary intended function, the dominant culture at midcentury provided them with the secondary intended function of acting as "miracle drugs." That

is to say the droogs are not the only ones to use amphetamines for performance enhancement: it is well-documented that England, along with the United States, authorized state-run programs that provided amphetamines to soldiers for improved and extended performance on the battlefield.³⁸ The dominant culture's use of psychopharmacology in this sense is technocratic insofar as the mechanism of its rule and the ordering of society are enhanced and controlled through medico-technological means.³⁹ In the case of military performance enhancers, psychopharmacology became a weapon of war to reinforce the state's dominant position in global politics and economics. The irony is that the British military used the drug to increase its capacity for violence, which is precisely why the teens consume *vellocet* and "milk plus knives": to sharpen up their martial prowess.

The teens' appropriation is parodic to the degree that the counterculture does violence to the hegemonic culture by using its own defense technology (drugs used for war) and its own disciplining technology (drugs used for psychiatry) against it. Furthermore, the re-contextualization of a military technology for performance enhancement fits within the structure of droog fashion, with its military components. Alex's description of the gang's fashion suggests that their clothing, as a cultural sign, has not only militaristic connotations but also martial ends. The militaristic connotations pertain more to the stylistic dimensions of their clothing: the teens wear waistcoats which, without lapels, resonate with military uniforms; in addition, the coats have faux shoulders, which appear to mock higher-ranking military uniforms and military insignia.⁴⁰ The gang's clothing also has practical purposes: their outfits are almost entirely black, providing the teens with partial camouflage for evading police during their nighttime exploits; they wear protective gear and bovver boots that allow them to deliver efficacious blunt-force *tolchocks* to their victims' or rivals' heads (4). Taking the military dimensions of the droogs' clothing into consideration when investigating their amphetamine use further suggests that part of the teens' drug use is a form of commandeering the dominant culture's technocratic signs.

Although the droogs use *vellocet* for performance enhancement, it is important to note that this is still a recreational drug for them. They derive pleasure from their ultra-violence, and the stimulant heightens and enhances not only their abilities but also their pleasure. The text makes direct correlations between the droogs' ultra-violence and the drugs they consume. For instance, after Alex and his gang leave the Korova Milkbar, they assault an older "schoolmaster type" (6). After

destroying his books, the teens “finished with the starry teacher veck,” on which Alex comments, “We hadn’t done much, I know, but that was only for the start of the evening. . . . *The knives in the milk-plus were stabbing away nice and horrowshow now*” (8, emphasis added). In this scene, the knives heighten, *sharpen*, Alex’s nervous system, further stimulating his excitement and pleasure along with his fighting prowess. The recreational re-contextualization of performance enhancement is particularly subversive as it makes the teens’ activities both play and rebellion; Alex derives more pleasure and more efficiency in his antisocial and countercultural activities while on stimulants. However, psychopharmacology does not remain in the hands of the counterculture for the duration of the novel; in part two, the state *re-appropriates* the technology from Alex in order to bring him back within the purview and discipline of the dominant culture.

Vaccinating Deviant Brains

In perhaps the most well-known section of the novel, Alex is “cured” of his antisocial sickness through the Ludovico technique, a new medical intervention that will replace Alex’s penal sentence. It is through the Ludovico technique that Alex’s deviant and countercultural subjectivity is remade into a docile one. The process of reconstituting Alex’s mind follows media theorist Dick Hebdige’s theorization of subcultural recuperation, in which “the fractured order is repaired and the subculture incorporated as diverting spectacle within the dominant mythology from which it in part emanates.”⁴¹ The fracture that Alex creates is repaired by means of aversion therapy exercised upon him by the state medical apparatus.

In a Foucauldian transplantation, the state moves Alex from the prison to the hospital, bringing him under a specific iteration of the medical gaze. Before he can be treated with pharmacological means, his deviancy must be pathologized as a “sickness” rather than classified as crime. This fits within what Hebdige characterizes as the ideological form of recuperation: “the ‘labelling’ and redefinition of deviant behavior by the dominant group—the police, the media, the judiciary.”⁴² Alex’s crime becomes a symptom of his diseased brain rather than an act of malice or evil. This “treatment” is a highly publicized spectacle, making his visible subjection to it quell the hysterical and moral outrage surrounding his crimes. When redefined under the clinical gaze, his deviant behavior is naturalized and domesticated.⁴³

As a patient, Alex is “reconstituted as an integral and thus governable aspect of mainstream existence, [and] the underworld of surveillance and regulation remains camouflaged, inviolable, ominously intact.”⁴⁴ While this is certainly an example of medicalization, I would suggest a more precise description: that the means through which discipline is imposed on Alex are neurological, based not on abstract psychoanalytic or even psychological thoughts but more on the *neuropsychological* and thus biological episteme of psychopathology—finding material bases and material interventions for Alex’s antisocial and countercultural behavior. This intervention is achieved through the “neuromolecular gaze.”⁴⁵

Although neurotransmitters and neurological imaging are not present in the novel, there are a number of examples of the medical gaze attempting to penetrate Alex’s body to read his brain’s response during his treatment.⁴⁶ Indeed, the Ludovico agent does not act independently; it works in conjunction with the entire Ludovico apparatus, which includes technologies for visualizing the body and brain. The scene in which Alex describes the first Ludovico session is the most explicitly neuroscientific: “But against the right-hand one of the other walls was a bank of all like little meters, and in the middle of the floor facing the screen was like a dentist’s chair with all lengths of wire running from it” (66). Alex also notes the extent to which other technological aspects of the treatment connect his body to the viewing room: “And then I had like a cap stuck on my gulliver and I could viddy all the wires running away from it, and they stuck like a suction pad on my belly and one on the old tick-tocker, and I could just viddy wires running away from those” (67). Although Alex lacks the biotechnological knowledge to accurately describe the equipment around him, we can infer its function. The wires appear to be part of a biometric monitoring apparatus: an electroencephalogram (EEG), measuring brain waves; a telemetry machine or electrocardiogram, measuring heart rate and wave forms; and some sort of device connected to his abdomen—perhaps an electromyogram (EMG)—measuring the muscle contraction of his abdominal muscles or smooth digestive muscles, which could indicate noxious and gastric responses. Though the electromyogram’s first clinical use was in 1928, it did not become a mainstream technology in neurology or muscular studies until the mid-1950s, making it contemporaneous with Burgess’s novel.⁴⁷ The EMG and EEG visualize the efficacy of the treatment. More specifically, the connections between Alex’s brain and the rest of him map the topography of his neurological body.⁴⁸

The measurement of Alex's body is just as important as the measurement of his brain, as the treatment seeks to create a circuit: viewing ultra-violence triggers nausea, which bespeaks the neurological materialism of the intervention. Alex can presumably retain the memory on both a cognitive and a visceral level in the same way that we avoid dangerous stimuli without even thinking about it: Dr. Brodsky tells Alex that he is not considered cured until his "body reacts promptly and violently to violence, as to a snake, without further help from us, without the medication" (76). Alex will then know to avoid such violent and antisocial situations and behaviors; but, in case he forgets and chooses to expose himself to violence anyway, his body will respond violently and prevent him from doing so. Alex's body will rebel against itself, somewhat like an autoimmune response, rather than against the culture that has discursively and materially created it.

The correlation to immune response is significant since Alex, like William Burroughs, describes the treatment's ultimate, rather than proximate, effects in terms of vaccination. Alex fails to make an explicit connection between his sickness, the drug, and the ultra-violent films Dr. Brodsky is showing him during the majority of the treatment. However, he does finally come to understand that the end result is a form of control and permanent programming. Once the drug and the cine-therapy have been dosed to effect, Alex realizes that, "this Ludovico stuff was like a *vaccination* and there it was cruising about in my krovvy, so that I would be sick always and for ever and ever amen whenever I viddied any of this ultra-violence" (78, emphasis added). The implication is that the drug has a permanent physiological effect without any maintenance dosing. Alex's neurological body will forever react abjectly to violence, altering his ability to decide to be violent or anti-social. This parameterization of human autonomic response within the medicalized framework of "health" demonstrates the ways in which morality and biopolitical imperatives can be fundamentally enmeshed in neuroscientific discourses of behavior.

The treatment's mechanism of action becomes a biological analog to the discursive reconstitution of Alex's subjectivity. The medical team intervenes on the same pathways of the brain's pleasure center except that the treatment works on fear rather than euphoria, hijacking the manner in which Alex uses drugs for rape and ultra-violence. In this sense, the team recovers him at a neurobiological level, using his own brain against himself. The Ludovico agent appears to function as an emetic, acting directly on the "vomit center" of the brain in the medulla, precisely like apomorphine.⁴⁹ This technology

is psychopharmacological insofar as it affects Alex's behavior by acting as an inverse of the euphoric response from a narcotic or similar psychoactive. The drug's action is *neuropsychopharmacological* in the sense that it affects his behavior through a chemical manipulation of the complex processes of motivation. The medical team uses biomedical advancements in neuroscience to bypass Alex's cognitive faculties. They are, in a sense, short-circuiting his prefrontal cortex by making an autonomic reaction or a kind of mesolimbic and "reptilian-brain" inscription. The neuroscientists want to short-circuit thought altogether, rewiring his brain at an instinctual level. This does resonate as an aversive counterpoint to the addictive agents: "Repeated use of [an addictive] drug changes the brain of the user so that behaviors become more reflexive and, consequently, much less amenable to cognitive interference."⁵⁰ The powerful driving force of the mesolimbic reward pathway can explain, for example, why it can be difficult for a drug addict to simply "decide" not to ingest a drug as their "pleasure center" signals the body to crave the drug at a visceral level rather than to desire it at a level of complex reasoning. I would speculate that the Ludovico treatment establishes a mesolimbic-like response to violence and sex, as recent research into the neurobiology of aversive states has suggested that the reward and aversion pathways appear to have "overlapping neural systems."⁵¹ Following treatment, Alex's brain is inscribed with the fear-aversion response linked to that specific stimulus. Fear of pain prevents him from acting or continuing to think about ultra-violence. The technique even has a biophysical failsafe: if he tries to withstand the discomfort, the debilitating effects from the pain and nausea will cause his body to shut down. "Mind over matter" becomes a moot point.

The materialization of Alex's behavioral deviance raises a number of problems with respect to medical ethics, and reflects a kind of social engineering of behavior that is foregrounded by the view of the body as a machine. The medical team, led by Dr. Brodsky and Dr. Branom, does not initially give Alex any information about the drug or the procedure, which raises its own ethical concerns regarding informed consent. When Alex asks if it is vitamins that are in the hypodermic, Dr. Branom responds, "Something like that," letting Alex think that that Ludovico is just a supplement to make him healthier (65). In fact, as Alex first experiences the drug's effects, he attributes them not to the shot of "vitamins" but instead to the wires and sensors that were placed on his head and body while watching the films. When Alex watches the films, he begins to feel "sick" (68). His head throbs

"like a bolshy big engine that makes pain" (70). While his headache is certainly part of the mechanism that causes the nausea, the simile in itself is telling. The fact that his head is compared to a big engine (one capable of making pain) suggests that it is a machine that has been "engineered," signaling the technocratic manipulation of the body via the brain.

The neurological underpinning of the Ludovico intervention makes the engine simile all the more relevant. One might argue that this treatment is purely psychological; however, I would suggest that such a reading disregards two important points: first, during the late 1950s and through the 1960s, the study of psychology was increasingly materially grounded in neurobiology, which makes it difficult to argue that this procedure was purely an attempt to condition Alex's "mind" rather than affect his "brain."⁵² Second, the very mechanism of aversion therapy functions on a neurological level.⁵³ The pain-driving engine suggests that psychiatry and psychopharmacology are being implemented to make Alex's mind a disciplined machine that allows his body to act only within the prescribed parameters of a fear-based neuroscience. This machine causes pain in accordance with whatever parameters the neuropsychological "engineers" set.⁵⁴

Alex begins to see the connection between the treatment and the sickness, raising questions concerning the construction of his pathology and its subsequent treatment. At various points, he accuses the clinicians of making him sick. After the traumatic first session, Dr. Branom describes to Alex the "normal human healthy" response to violence and evil. He explains that he "is being made sane, [he] is being healthy." In response, Alex rebukes him: "'That I will not have,' I said, 'nor can understand at all. What you've been doing is to make me feel very very ill. . . . You must be doing something to me to make me feel ill.'" Branom reiterates his point: "You felt ill this afternoon . . . because you are getting better. When we're healthy we respond to the presence of the hateful with fear and nausea" (71). Alex considers health to be the absence of pain or malaise, while Dr. Branom views it in terms of a naturalized ethic of social behavior, the noxious response to violence and hate. This position reflects the biomedical establishment's processes of rebuilding Alex's subjectivity. By having his brain and body respond to the appropriate socially constructed forms of health based on behavioral regularization, the treatment precludes countercultural rebellion.

Beyond its noxious effects, the Ludovico technique also acts as an obstacle to Alex's countercultural rebellion in more subtle ways.

In an allusion to Pavlov's classical conditioning, Alex denounces the Governor and the clinical staff: "Am I just some animal or *dog*. . . . Am I just to be like a clockwork orange?" (83).⁵⁵ It is important to emphasize, as previously noted, that the Ludovico technique is not technically "brainwashing" (277); it is a form of aversion therapy that does not take away Alex's desire or will to act violently or defiantly, but instead limits his ability to act upon such desires. Even though the nausea is a visceral, bodily response, it is still mediated through his brain, which must process whatever violence he sees; this, then, triggers the drug's permanent mechanism that associates sex and violence (and classical music) with pain and nausea. The pharmaceutical and behavioral engineering more than weakens Alex's capacity for counter-cultural rebellion; it obliterates any possibility of aggressive action. As the experiment before the Governor demonstrates, he is not even capable of self-defense. The treatment not only reverses the effects of his appropriations of a technology that enhanced his violent performance (such as the use of amphetamines as a performance enhancer); in re-appropriating pharmacology back from the droog culture, the dominant culture actually negates its subcultural use. Once Alex is released, he could very well take *vellocet* or "milk plus knives," but he could no longer use these as ergogenic aids for ultra-violence. The only good such drugs like stimulants would do him would be to increase his productivity in the workforce, which is the dominant culture's ideal state for him—another efficient, disciplined, working-class laborer, with a brain operating as the driving "engine" of a reengineered human motor. Behavioral engineering diverts his energy for neurochemical resistance from deviance to productive neoliberal ends.

Ludovico also affects Alex's relationship with the hallucinogenic drugs he used previously in the novel. Returning to the opening scene in the Korova from the first chapter, we see Alex denouncing and assaulting an individual for using one of the hallucinogens:

I knew what it was like having tried it like everyone else, but this time I got to thinking it was a cowardly sort of *vershch*. . . . You were just going to get introduced to the old Bog or God when it was all over. You came back to the here and now whimpering, sort of with your rot all squaring up for a boohoo. Now that's very nice but very cowardly. You were not put on this earth just to get in touch with God. That sort of thing could sap all the strength and the goodness out of a *chelloveck*. (5)

Alex has tried this drug before and knows its hallucinatory, transcendental effect. He acknowledges that it has a depressing side effect during the come down, but that is not his main complaint. He finds the drug cowardly and dislikes the temporary anodyne it provides—seeing God. Furthermore, and more importantly, it deprives the user of strength. In essence, this counteracts the adrenergic effect of the stimulants he prefers; the hallucinogen would hinder his performance. The connection between the two classes of drugs is played out in the very next scene, in which Alex feels “the knives pricking up” and kicks the intoxicated individual in the head.

Taking these scenes into consideration, the fact that Alex very deliberately seeks out the hallucinogenic milk towards the end of the novel brings into question how Ludovico corrects his ability to use psychopharmacology as a tool of cultural subversion. It places him in a situation where he seeks out the milk in an effort to forestall the effects of Ludovico. After leaving the treatment center and then subsequently being rejected by his family, Alex returns to a former place of pleasure: the record store, MELODIA. He asks to listen to Mozart, forgetting that a side effect of Ludovico conditioning is a permanently noxious response to classical music because such music was played during the forced viewing of ultra-violence. As he begins to feel the “sickness,” he has an immediate visceral urge to go to the Korova Milkbar—“I knew what I wanted” (91)—where he orders a “Milk plus, large,” but does not tell us which additive he selects. Based on the milk plus’s effects—a vivid hallucination—I would suggest that it is either *synthemesc* or *drencrom*. The hallucination involves a piece of silver that begins to “grow and grow and grow” until it forms a bright light where a group of statues “of God or Bog and all His Holy Angels and Saints, all very bright like bronze . . . like moved and were alive.” Alex feels “real horrorshow, like in heaven” (91). However, the figures then shake their heads at him as the hallucination collapses upon itself, leaving him before “the empty glass on the table and wanting to cry and feeling like death was the only answer to everything” (92). For Alex, then, the concept of death represents an end to neurological function or cognitive function and prohibits neuroscientific intervention. If we are to believe that Alex’s behaviors have become like clockwork, then using milk plus as a coping mechanism for stress is predictable. However, he chooses the drug that “saps strength and goodness” (5). Recalling that Alex’s notion of “goodness” is by no means in line with the traditional definition, the implication of his compulsion to use a tranquilizing psychopharmaco-

logical agent as a response to stress post-Ludovico further crystallizes his docile subjectivity.

The actualization of this possibility, however, leads not to docile subjectivity but to suicidal ideation. Alex is placed in an impossible position in which all he wants is to “snuff it”; however, the violent nature of the act prevents him from contemplating suicide in depth. If he thinks about it, the violence inherent in the thought makes him ill. The only option he is able to investigate, before being assaulted by one of his former victims, is a pharmaceutical one—“Aspirin, that was it. You could snuff it on a hundred aspirin. Aspirin from the good old drugstore” (94). Beyond the reintroduction of the cycle of pharmacology as an interventional discourse, the fact that the treatment drives him to attempt suicide connects with the novel’s critique of psychiatry and neuroscience as technocratic instruments of dominant culture. The technocratically created body leads to self-destruction, thus acting in contradiction to its own putative goal of forestalling violence of any kind. As such, the state’s re-appropriation of psychopharmacology does not create a disciplined neurological body that is ultimately sustainable. In an appropriately biopolitical “make live and let die” fashion, the subject becomes the agent of his own elimination rather than forcing the state to intervene directly.⁵⁶

In the end, the treatment works to create a docile and disciplined subject. Alex does not die, and he survives to find out that his near-death experience has actually cured him of Ludovico’s restraints. However, as the controversial and problematic final chapter of the novel suggests, when Alex tries to regain his position as countercultural rebel and reassemble a gang of droogs, he finds his dissident desire lacking. When he sees his old droog Pete married and with a respectable job, Alex realizes that he must “groweth up” (121). He desires to become part of the heteronormative societal equation: get married; get a job; have kids. After the release from interventional behavior modification, the subject is empowered to articulate and want a normative subjectivity that maintains and reproduces ideological structures. The vaccine has worked.

A Clockwork Orange reflects and impinges upon a specific and crucial biopolitical moment. Where the patient was once seen as a passive object of the medico-psychiatric gaze in a top-down structure of medical hierarchy, we now see the text articulating how the normalization of and aversion to deviant mental states become inculcated in and self-actualized by individuals. This shift coincides—more than conveniently—with deinstitutionalization and its aftermath. The novel

certainly added to critiques of the intersection of neuroscientific research in behavior control, informed consent, and experimentation on prisoners. For instance, in 1971 Jessica Mitford published *Kind and Usual Punishment*, an extended indictment of the American prison system, and she titles her chapter on experimental behavior modification of prisoners during the 1950s through the early 1970s “A Clockwork Orange.” However, while resistance and outrage was occurring on this front, the transition in medicine to patient empowerment and self-education would lead to neurological self-fashioning through pharmaceuticals.⁵⁷ This kind of logic leads not to aversive treatments or brainwashing but rather to moments of pre-intervention following the neoliberal rhetoric of self-improvement, and optimization through psychopharmacology and risk management.⁵⁸ The goal is not to recuperate figures like Alex but to “screen and intervene” before they can use drugs illicitly and become fully pathologized deviants. We become obliged to take responsibility for our own neurobiology and bear the accountability of freedom, as Nikolas Rose has suggested.⁵⁹ Burgess’s novel, then, does articulate and reflect how psychopharmacology and neuroscience mediates cultural strata beginning in the long 1960s, how the counterculture was merely aping the establishment by appropriating psychopharmacology to its own illicit use. But its legacy of demonizing a dystopian state of technocratic dominant culture that controls through medicine obscures its less obvious cultural impact: detracting attention from newer, subtler, and non-aversive forms of neuroscientific behavior modification and subjectification. And in our contemporary moment of psycho-pharmaceuticalization, it is these subtler forms which deserve our most careful scrutiny.

NOTES

1. Burgess, 1985, 91. Emphasis added.
2. McCracken, 277.
3. Evans, 408; Biswell, Introduction, xix.
4. For linguistic readings of Burgess’s novel, see Carson, “Pronominalization”; Goh, “‘Clockwork’ Language”; Petix, “Linguistics, Mechanics.” See also Rabinovitz’s “Ethical Values” for a discussion of the novel vis-à-vis ethics.
5. Hebdige, 135.
6. Biswell, Introduction, ix.
7. Ibid., xi.
8. Burgess, “Clockwork Condition,” 227.
9. Ibid., 234.
10. Although soma, the pharmaceutical agent in *Brave New World*, is an anodyne rather than an aversive agent, it is the use of pharmacology as a tool of subjection that links Burgess’s text with Huxley’s.

11. Rose and Abi-Rached, 3.
12. The movement can be said to begin in the late 1950s and die down in the early to mid-1970s, or more precisely span from 1958 to 1974. See Head, 25.
13. Rose and Abi-Rached, 38.
14. Collura, 481, 486.
15. Healy, 37.
16. Ibid, 99–101.
17. Schildkraut, 124.
18. This scene has been famously demythologized by Foucault in *Madness and Civilization*.
19. Killaspy, 248.
20. Szasz, 188.
21. Glatt, 163.
22. Petersen, 7.
23. Szasz, 279.
24. "Drug for Drunks."
25. Bradley, 325.
26. Dickinson et al., 1349.
27. Burroughs, 204.
28. Biswell, *Real Life*, 300.
29. Burroughs, 202. Although I am citing the 2003 reprinted restored text, the section on apomorphine is present in the 1959 Olympia edition.
30. Crossley, 878.
31. Laing, xii. Although this is the 2010 reprint, the quotation I cite is in the preface of the 1964 edition.
32. Evans, 408.
33. Biswell, Introduction, xix.
34. Burgess, *Clockwork Orange*, 3. Hereafter cited parenthetically in the text.
35. Osmond, 778; Hoffman, 91–106. Adrenochrome is perhaps best remembered as the mythic and exotic drug in Hunter S. Thompson's *Fear and Loathing in Las Vegas*: "the first wave felt like a combination of mescaline and methedrine. . . . My body felt like I'd just been wired into a 220 volt socket" (132). According to Thompson's mythology, the drug must be extracted from the adrenal gland of a live donor.
36. Costello, 187.
37. Plant et al., 10.
38. Rasmussen, 974. This did not end after World War II. In 2006, the BBC found evidence that the Ministry of Defence was testing and stockpiling "stay awake pills" and Erythropoietin (a synthetic blood-doping agent) in anticipation of the Iraq war. See Wheeler, "UK Army."
39. Davis-Floyd, 46–47.
40. Compare this with Alex's dream foreshadowing his underlings' betrayal and conversion to instruments of state power: Georgie appears with three stars on his *pletchoes* "like a general" and "[brings] in old Dim with a whip" (26). The faux shoulders also seem to parody Alex's probation officer, Mr. *Deltoid*.
41. Hebdige, 131.
42. Ibid.
43. Ibid., 133.
44. Johnson, 290.
45. Rose and Abi-Rached, 38.
46. On the development of the medical gaze in the era of modern neuroimaging, see Rose and Abi-Rached, 38; see also Dumit's *Picturing Personhood*.
47. DeBacher, 457–58.

48. Foucault describes the shift from madness being a diagnosis of “absolute truth” to a differential one that reflected aberrant reflexes of the nervous system. Psychiatric diagnosis could bypass the patient’s voice entirely as the doctor could “read” and intervene on the nervous system directly. For Foucault, this process created the psychiatric patient’s “neurological body” (*Psychiatric Power*, 307–8).

49. Although apomorphine does act on the brain, the “chemo-trigger zone” is outside the blood-brain barrier (Donnerer, 2).

50. Baler and Volkow, 559.

51. Umberg and Pothos, 72.

52. Rose and Abi-Rached, 36.

53. Umberg and Pothos, 70.

54. Dempsey, 519.

55. See Rawlinson’s note in Burgess, *Clockwork Orange*, 83, n2.

56. This notion speaks to the shift in sovereign power that Foucault articulates in his lectures on biopolitics. Biopower acts on the aggregate to regulate life and death of citizens (*Society*, 251). A relevant example: certain populations may not be discouraged or inhibited too directly from participating in life-threatening behavior such as drug use, and are not given easy access to treatment. Others may be offered, or have, easy access and means for rehabilitation.

57. Rose and Abi-Rached, 220.

58. *Ibid.*, 15. See also Rose’s earlier work on risk, biopolitics, and “neurochemical selves” in *The Politics of Life Itself*, chapters 4 and 7.

59. Rose and Abi-Rached, 21.

BIBLIOGRAPHY

- Baler, Ruben D., and Nora D. Volkow. “Drug Addiction: The Neurobiology of Disrupted Self-Control.” *Trends in Molecular Medicine* 12, no. 12 (2006): 559–66.
- Biswell, Andrew. *The Real Life of Anthony Burgess*. London: Picador, 2005.
- . Introduction to *A Clockwork Orange (Restored Text)*, edited by Andrew Biswell. New York: W. W. Norton, 2012.
- Bradley, Philip B. *Introduction to Neuropharmacology*. London: Wright, 1989.
- Burgess, Anthony. 1985. London: Hutchinson, 1978.
- . “The Clockwork Condition.” *New Yorker*, June 4, 2012: 69–76.
- . *A Clockwork Orange: Authoritative Text, Backgrounds and Contexts, Criticism*. Edited by Mark Rawlinson. Norton Critical Editions. New York: W. W. Norton, 2011.
- Burroughs, William S. *Naked Lunch*. New York: Grove Press, 2003.
- Carson, Julie. “Pronominalization in a Clockwork Orange.” *Papers on Language and Literature* 12, no. 2 (Spring 1976): 200–5.
- Collura, T. F. “History and Evolution of Electroencephalographic Instruments and Techniques.” *Journal of Clinical Neurophysiology* 10, no. 4 (1993): 476–504.
- Costello, Donald P. “From Counterculture to Anticulture.” *The Review of Politics* 34, no. 4 (1972): 187–93.
- Crossley, Nick. “R. D. Laing and the British Anti-Psychiatry Movement: A Socio-Historical Analysis.” *Social Science and Medicine* 47, no. 7 (1998): 877–89.
- Davis-Floyd, Robbie E. “The Technocratic Model.” In *Birth as an American Rite of Passage: Second Edition, with a New Preface*, edited by Robbie E. Davis-Floyd, 44–72. Berkeley: University of California Press, 2004.
- DeBacher, Gary A. “Electromyography.” In *Experimental Techniques in Human Neuropsychology*, edited by H. Julia Hannay, 457–513. New York: Oxford University Press, 1986.

- Dempsey, David. "Shrinks and the Shrunken in Modern Fiction: The Psychotherapist as Villain." *Antioch Review* 46, no. 4 (1988): 514–21.
- Dickinson, Tommy, Matt Cook, John Playle, and Christine Hallett. "'Queer' Treatments: Giving a Voice to Former Patients Who Received Treatments for Their 'Sexual Deviations.'" *Journal of Clinical Nursing* 21, no. 9–10 (2012): 1345–54.
- Donnerer, Josef. "The Emetic Reflex Arc." In *Antiemetic Therapy*, edited by Josef Donnerer, 1–10. Basel, Switzerland: Karger, 2003.
- Dumit, Joseph. *Picturing Personhood: Brain Scans and Biomedical Identity*. Princeton, NJ: Princeton University Press, 2004.
- "Drug for Drunks." *Time*, December 6, 1948. <http://content.time.com/time/magazine/0,9263,7601481206,00.html>.
- Evans, Robert O. "Nadsat: The Argot and Its Implications in Anthony Burgess's *A Clockwork Orange*." *Journal of Modern Literature* 1, no. 3 (1971): 406–10.
- Foucault, Michel. *Psychiatric Power: Lectures at the Collège de France, 1973–74*. Translated by Graham Burchell. New York: Picador, 2006.
- . *Society Must Be Defended: Lectures at the Collège de France, 1975–76*. Translated by David Macey. New York: Picador, 2003.
- Glatt, M. M. "Treatment Results in an English Mental Hospital Alcoholic Unit." *Acta Psychiatrica Scandinavica* 37, no. 2 (1961): 143–68.
- Goh, Robbie B. H. "'Clockwork' Language Reconsidered: Iconicity and Narrative in Anthony Burgess's *A Clockwork Orange*." *Journal of Narrative Theory* 30, no. 2 (2000): 263–80.
- Head, Dominic. *The Cambridge Introduction to Modern British Fiction, 1950–2000*. Cambridge, UK: Cambridge University Press, 2002.
- Healy, David. *The Creation of Psychopharmacology*. Cambridge, MA: Harvard University Press, 2002.
- Hebdige, Dick. *Subculture: The Meaning of Style*. London: Routledge, 1984.
- Hoffman, Albert. "The Discovery of LSD and Subsequent Investigations on Naturally Occurring Hallucinogens." In *Discoveries in Biological Psychiatry*, edited by Frank J. Ayd and Barry Blackwell, 91–106. Philadelphia: J. B. Lippincott, 1970.
- Johnson, Sam. "Rebellion and Accommodation." In *A Clockwork Orange: Authoritative Text, Backgrounds and Contexts, Criticism*, edited by Mark Rawlinson, 285–90. New York: W. W. Norton, 2011.
- Killaspay, Helen. "From the Asylum to Community Care: Learning from Experience." *British Medical Bulletin* 79–80, no. 1 (2006): 245–58.
- Laing, R. D. *The Divided Self: An Existential Study in Sanity and Madness*. London: Penguin, 2010.
- McCracken, Steven. "Free Will and Ludovico's Technique." In *Clockwork Orange: Authoritative Text, Backgrounds and Contexts, Criticism*, edited by Mark Rawlinson, 285–90. New York: Norton, 2011.
- Osmond, Humphrey. "Models of Madness." *New Scientist* 62, no. 267 (1961): 777–80.
- Petersen, E. N. "The Pharmacology and Toxicology of Disulfiram and Its Metabolites." *Acta Psychiatrica Scandinavica* 86, no. S369 (1992): 7–13.
- Petix, Esther. "Linguistics, Mechanics, and Metaphysics: Anthony Burgess's *A Clockwork Orange* (1962)." In *Old Lines, New Forces: Essays on the Contemporary British Novel: 1960–1970*, edited by Robert K. Morris, 38–53. London: Associated University Presses, 1972.
- Plant, Martin, Roy Robertson, Patrick Miller, and Moira Plant. *Drug Nation: Patterns, Problems, Panics, and Policies*. New York: Oxford University Press, 2010.
- Rabinovitz, Rubin. "Ethical Values in Anthony Burgess's *A Clockwork Orange*." *Studies in the Novel* 11, no. 1 (Spring 1979): 43–50.
- Rasmussen, Nicolas. "America's First Amphetamine Epidemic 1929–1971: A Quantitative and Qualitative Retrospective with Implications for the Present." *American Journal of Public Health* 98, no. 6 (2008): 974–85.

- Rose, Nikolas S. *The Politics of Life Itself*. Princeton, NJ: Princeton University Press, 2007.
- Rose, Nikolas S., and Joelle M. Abi-Rached. *Neuro: The New Brain Sciences and the Management of the Mind*. Princeton, NJ: Princeton University Press, 2013.
- Schildkraut, Joseph. "The Catecholamine Hypothesis of Affective Disorders: A Review of Supporting Evidence." *American Journal of Psychiatry* 122, no. 5 (November 1965): 509–22.
- Szasz, Thomas. *Coercion as Cure: A Critical History of Psychiatry*. New Brunswick, NJ: Transaction Publishers, 2007.
- Thompson, Hunter S. *Fear and Loathing in Las Vegas: A Savage Journey to the Heart of the American Dream*. New York: Random House, 2010.
- Umberg, Erin N., and Emmanuel N. Pothos. "Neurobiology of Aversive States." *Physiology and Behavior* 104, no. 1 (July 25, 2011): 69–75.
- Wheeler, Brian. "UK Army Tested 'Stay Awake' Pills." *BBC News*. Published electronically October 26, 2006. http://news.bbc.co.uk/1/hi/uk_politics/6083840.stm.