
Patents and Public Health: The Problems with Using Patent Law Proposals to Combat Antibiotic Resistance

Jessica P. Schulman

Follow this and additional works at: <https://via.library.depaul.edu/law-review>

Recommended Citation

Jessica P. Schulman, *Patents and Public Health: The Problems with Using Patent Law Proposals to Combat Antibiotic Resistance*, 59 DePaul L. Rev. 221 (2009)

Available at: <https://via.library.depaul.edu/law-review/vol59/iss1/7>

This Comments is brought to you for free and open access by the College of Law at Via Sapientiae. It has been accepted for inclusion in DePaul Law Review by an authorized editor of Via Sapientiae. For more information, please contact digitalservices@depaul.edu.

PATENTS AND PUBLIC HEALTH: THE PROBLEMS WITH USING PATENT LAW PROPOSALS TO COMBAT ANTIBIOTIC RESISTANCE

INTRODUCTION

The discovery of penicillin and sulfonamide in the 1930s and 1940s allowed for the quick and easy treatment of bacterial infections that were once life-threatening.¹ However, shortly after antibiotics came into widespread use, bacteria began resisting their effects.² Unfortunately, when bacteria become resistant to a particular antibiotic, the antibiotic is no longer effective against that bacteria.³ Antibiotic resistance is now a serious threat to global public health.⁴ Although altering patent law has been suggested as a way to ameliorate this problem, it is unlikely to effectively do so.

Antibiotic resistance can result in longer illness and even death if there are no antibiotics that can target the bacteria that caused the infection.⁵ Antibiotic resistance comes at a high cost to society because antibiotic-resistant infections increase medical expenses and decrease productivity.⁶ Faced with the serious repercussions of antibiotic resistance, public health authorities encourage the conservation of existing antibiotics and the development of more novel antibi-

1. See Otto Cars & Per Nordberg, *Antibiotic Resistance—The Faceless Threat*, in *THE GLOBAL THREAT OF ANTIBIOTIC RESISTANCE: EXPLORING ROADS TOWARDS CONCERTED ACTION 1* (2004), available at http://www.dhf.uu.se/antibiotics_participant/new_pdf/Faceless_Threat.pdf.

2. *Id.*

3. *Id.*

4. See Brad Spellberg et al., *The Epidemic of Antibiotic-Resistant Infections: A Call to Action for the Medical Community from the Infectious Diseases Society of America*, 46 *CLINICAL INFECTIOUS DISEASES* 155, 155 (2008), available at www.idsociety.org/WorkArea/DownloadAsset.aspx?id=9048 (“We are in the midst of an emerging crisis of antibiotic resistance for microbial pathogens in the United States and throughout the world.”).

5. See Thomas G. Slama, *Gram-Negative Antibiotic Resistance: There Is a Price to Pay*, 12 *CRITICAL CARE* S4, S7 (2008), available at <http://ccforum.com/content/pdf/cc6820.pdf> (“[P]atients infected with resistant strains of key Gram-negative pathogens have increased mortality [and] longer hospital stays . . . than those infected by [antibiotic] susceptible strains.”); B. Spellberg et al., *Societal Costs Versus Savings from Wild-Card Patent Extension Legislation to Spur Critically Needed Antibiotic Development*, 35 *INFECTION* 167, 168 (2007) (“[U]p to seventeen days of extra hospitalization due to infection caused by a multi-drug resistant versus a non-multi-drug-resistant *P. aeruginosa* [a Gram-negative bacteria].”).

6. See Spellberg et al., *supra* note 5, at 169 tbl.1 (factoring reduced indirect costs, such as lost productivity, as a societal saving from a novel antibiotic).

otics.⁷ Conserving antibiotics involves limiting the use of antibiotics to situations in which they are absolutely necessary. This aims to delay the onset and spread of antibiotic resistance.⁸ Developing novel antibiotics ensures that when existing antibiotics are no longer effective, new antibiotics that are capable of treating the resistant bacteria are available.⁹ However, conservation has not been successful,¹⁰ and the development of novel antibiotics continues to stagnate.¹¹

In recent years, public health authorities and scientists have expressed concern about the decline in the research and development of novel antibiotics.¹² To rectify the situation, they suggest providing additional financial incentives to drug developers,¹³ including tax credits and longer patent terms.¹⁴ Recent congressional proposals have also sought to encourage antibiotic development by offering patent-based incentives, such as extended patent terms for novel antibiotics.¹⁵

7. See Spellberg et al., *supra* note 4, at 157 (“Clearly, it is desirable to use antibiotics only when appropriate, to try to limit selective pressure that increases the frequency of resistance.”); Spellberg et al., *supra* note 5, at 167.

8. See Spellberg et al., *supra* note 4, at 157.

9. LAURIE GARRETT, *THE COMING PLAGUE* 430–31 (1994) (discussing how physicians switched to new classes of antibiotics when older classes were no longer working and that “[p]harmaceutical companies were searching for radically different ways of attacking the microbes.”); *cf.* Cars & Nordberg, *supra* note 1, at 4 (“[B]ecause of the previously continuous development of new antibacterial agents it has been possible, in countries where new drugs are affordable, to change the therapy to new antibiotics when resistance levels to older ones have become ‘uncomfortably high.’”); INFECTIOUS DISEASES SOC’Y OF AM., *BAD BUGS, NO DRUGS: AS ANTIBIOTIC DISCOVERY STAGNATES . . . A PUBLIC HEALTH CRISIS* BREWS 1, 3 (July 2004) [hereinafter *BAD BUGS*] (“Until recently, research and development (R&D) efforts have provided new drugs in time to treat bacteria that became resistant to older antibiotics.”).

10. See Arch G. Mainous III et al., *An Evaluation of Statewide Strategies to Reduce Antibiotic Overuse*, 32 *FAMILY MED.* 22, 28 (2000).

11. See Allison E. Aiello et al., *Antimicrobial Resistance and the Ethics of Drug Development*, 96 *AM. J. PUB. HEALTH.* 1910, 1910 (2006) (“[D]evelopment of new classes of antimicrobials has been at a virtual standstill since the late 1970s.”); Martin L. Katz et al., *Where Have All the Antibiotic Patents Gone?*, 24 *NATURE BIOTECHNOLOGY* 1529, 1529 (2006) (“[P]harma companies are developing fewer antibiotics in comparison with other therapeutic categories.”).

12. See Spellberg et al., *supra* note 4, at 155.

13. See Slama, *supra* note 5, at S5 (“Large pharmaceutical companies will only develop new antimicrobial agents if the federal government provides financial incentives through better patent protection or acceptable reimbursement rates.”).

14. See Aiello et al., *supra* note 11, at 1912 (“The public sector could provide additional incentives (market exclusivity, patent extension, tax incentives, and expedient Food and Drug Administration approval times) and mitigation of risks (indemnification against liability and guaranteed markets) to the private sector in return for the successful development of new drugs.”); *BAD BUGS*, *supra* note 9, at 3 (“[I]ncentives most likely to spur R&D within major pharmaceutical companies include those that provide financial benefits prior to a drug’s approval (e.g., tax credits for R&D).”).

15. See S. 975, 109th Cong. § 202 (2005) (proposing an addition to Title III of the Public Service Act, 42 U.S.C. 243, which requires that those countermeasures eligible for a patent term

Many scientists and politicians believe that patent-based incentives would persuade drug developers to invest in antibiotic development.¹⁶

This Comment argues that, contrary to these beliefs, the patent law system further exacerbates the problem of antibiotic resistance.¹⁷ The patent bargain between the inventor and society functions differently for antibiotics than other inventions.¹⁸ Generally, the inherent usefulness of an invention is not altered by an inventor's incentive to exploit the value of the invention while it is being protected by the patent.¹⁹ However, the exploitation of antibiotics leads to overuse of the antibiotic and can result in antibiotic resistance.²⁰ In addition, from a public health perspective, the optimal use of antibiotics involves delaying the introduction of new antibiotics until existing antibiotics are ineffective.²¹ This waiting period is incompatible with a patent structure that grants a limited monopoly to an inventor as soon as the inventor applies for a patent.²²

Thus, patent law cannot effectively solve the problem of antibiotic resistance because patent law does not encourage the development of antibiotics or the conservation of existing antibiotics.²³ Consequently, Congress will not encourage the development of novel antibiotics that affect antibiotic-resistant bacteria by granting patent term extensions to antibiotic developers.²⁴ Yet even if antibiotic conservation within the United States could be attained by altering patent law, the use and overuse of antibiotics in other countries would still lead to resistance in the United States.²⁵

The most effective way to slow antibiotic resistance involves closely regulating antibiotic use and cycling the use of certain antibiotics over

extension include "biological and chemical agents, toxins, and nuclear and radiological materials that may be used as weapons of mass destruction or that are infectious diseases.").

16. See Spellberg et al., *supra* note 5, at 167 ("Wild-card patent extension appears to be a cost-effective strategy to spur anti-infective development.").

17. See *infra* notes 122–135 and accompanying text.

18. See *infra* notes 113–121 and accompanying text.

19. BAD BUGS, *supra* note 9, at 17 ("Antibiotics and other antimicrobials are the only drugs where extensive use leads to loss of benefit.").

20. Mainous et al., *supra* note 10, at 22 ("Overuse of antibiotics has been linked to rates of antibiotic resistance."); cf. BAD BUGS, *supra* note 9, at 17 ("[E]xtensive use leads to loss of benefit.").

21. See *infra* notes 255–260 and accompanying text.

22. See *infra* notes 122–135 and accompanying text.

23. See *infra* notes 246–264 and accompanying text.

24. See *infra* notes 155–237 and accompanying text.

25. See Kevin Outterson, *The Vanishing Public Domain: Antibiotic Resistance, Pharmaceutical Innovation and Intellectual Property Law*, 67 U. PITT. L. REV. 67, 93, 100 (2005).

a long period of time.²⁶ Unfortunately, these measures would further decrease novel antibiotic development because drug developers would have little financial incentive to develop antibiotics.²⁷ In turn, the problems posed by antibiotic resistance would grow because, regardless of how carefully existing antibiotics are used, resistance makes the development of novel antibiotics necessary.²⁸ Instead, the government should pursue antibiotic development itself, to ensure that sufficient antibiotic development takes place, and to ensure that those developed antibiotics are conserved appropriately.

Part II of this Comment explores the causes of antibiotic resistance, the reasons why it poses a significant danger to health and welfare, the statutory patent term in the United States, and the recent attempts to reform patent law by extending the patent term.²⁹ Part III argues that recent proposals to alter patent law would not solve antibiotic resistance.³⁰ Part IV discusses non-patent-related proposals and argues that the government should pursue antibiotic research itself.³¹

II. BACKGROUND

This Part provides an overview of the causes of antibiotic resistance, current patent law, and patent law proposals pertaining to antibiotics. Section A discusses the biological and epidemiological causes of antibiotic resistance, the public health threat that antibiotic resistance poses, and the reasons that antibiotic development has stagnated.³² Section B discusses current patent term extensions available for novel drugs, recent legislation seeking to extend the patent term, and recent legislation that institutes a patent prize system for pharmaceuticals companies.³³

26. Matthew S. Dryden et al., *Antibiotic Stewardship—More Education and Regulation Not More Availability?*, 64 J. ANTIMICROBIAL CHEMOTHERAPY 885, 887 (2009), available at <http://jac.oxfordjournals.org/cgi/reprint/dkp305v1> (“How can the dilemma of optimal treatment for individuals and at the same time reduction in the volume of antibiotic use, thereby reducing the selective pressure on bacterial ecology be resolved? Probably the only way is to have more, not less, regulation of the use of antibiotics.”); Rekha Murthy, *Implementation of Strategies to Control Antimicrobial Resistance*, 119 CHEST 405S, 409S (“Specific measures to manage antimicrobial resistance by modifying patterns of antibiotic use may include *restriction of certain classes of antibiotics, rotating or cycling classes of antibiotics periodically, or open fomularies.*”) (emphasis added).

27. See *infra* notes 245–246 and accompanying text.

28. See Oüttersson, *supra* note 25, at 69.

29. See *infra* notes 32–108 and accompanying text.

30. See *infra* notes 109–264 and accompanying text.

31. See *infra* notes 265–268 and accompanying text.

32. See *infra* notes 34–63 and accompanying text.

33. See *infra* notes 64–108 and accompanying text.

A. Antibiotic Resistance

Bacterial and human cells use similar cellular structures and pathways to operate.³⁴ In order to target bacterial cells without harming human cells, antibiotics target bacterial structures or pathways that humans lack.³⁵ By doing so, the antibiotic can destroy the bacteria without hurting the human who takes the antibiotic. Because human and bacterial cells are similar, it is difficult to find an agent that can effectively target the bacterial structure or pathway without harming the human cells. Due to the limited number of agents that can accomplish this goal, numerous antibiotics have similar chemical structures that target the same bacterial structure or pathway.³⁶

Many successful antibiotics were discovered by observing how other organisms, such as fungi, inhibit the growth of bacteria.³⁷ Antibiotics discovered from these natural sources are very effective against bacteria because the natural sources have been fighting bacteria for more than two billion years.³⁸ However, bacteria have been exposed to the bacteria-fighting properties of those natural sources for an equally long period of time. As a result, when those antibiotics were discovered, strains of bacteria that could resist the antibiotics emerged almost immediately,³⁹ due to both the natural evolution of bacteria and the overuse and misuse of antibiotics.⁴⁰ Because of this long-term exposure, bacteria that can resist antibiotics are the most likely to survive.⁴¹ Humans have accelerated this evolution by exposing bacteria

34. See DAVID L. NELSON & MICHAEL M. COX, *LEHNINGER PRINCIPLES OF BIOCHEMISTRY* 6 (4th ed. 2005).

35. For example, penicillin targets an enzyme that is critical to effective bacterial cell wall synthesis but that is absent in humans. *Id.* at 779.

36. For example, penicillin and amoxicillin have similar structures and target the same bacterial structure. Thus, they are considered to be members of the same class of antibiotic—the beta-lactam class. See Tami Port, *MOA of Penicillin Antibiotics*, Apr. 20, 2009, http://bacteriology.suite101.com/article.cfm/moa_of_penicillin_antibiotics. (last visited Aug. 7, 2009)

37. For example, penicillin was discovered by observing the ability of a certain fungus to inhibit the growth of bacteria. See Am. Chem. Soc’y., *The Discovery and Development of Penicillin*, <http://acswebcontent.acs.org/landmarks/landmarks/penicillin/discover.html> (last visited Aug. 7, 2009).

38. See Spellberg et al., *supra* note 4, at 157 (“Genetic analysis of microbial metabolic pathways indicates that microbes invented both β -lactam antibiotics and β -lactamase enzymes to resist those antibiotics >2 billion years ago.”).

39. See Aiello et al., *supra* note 11, at 1910 (“Shortly after the widespread use of penicillin that followed World War II, penicillin-resistant strains of *S aureus* [a bacteria] began to emerge in hospitals.”).

40. See Spellberg et al., *supra* note 4, at 156–57.

41. *Id.* at 157 (“[M]icrobes have had collective experience creating and defeating antibiotics Microbes do not need our help in creating antibiotic resistance.”).

to “thousands of metric tons of antibiotics . . . used in patients and livestock over the past half century.”⁴²

The rise in antibiotic-resistant infections has serious health implications.⁴³ Infectious diseases are the second leading global cause of death.⁴⁴ In the United States, infectious diseases are the third leading cause of death.⁴⁵ These statistics are likely to increase as antibiotic-resistant infections become more prevalent because antibiotic-resistant infections cause a higher mortality rate⁴⁶ and a higher risk of secondary complications than antibiotic-susceptible infections.⁴⁷ In addition to the loss of human life, antibiotic resistance costs billions of healthcare dollars because antibiotic-resistant infections take longer to cure and often require the use of more expensive drugs.⁴⁸

When a bacterial infection is resistant to a particular antibiotic, the infection must be treated by a different antibiotic.⁴⁹ However, in many instances, the resistant bacteria is also resistant to other classes

42. *Id.*

43. See Slama, *supra* note 5, at S4 (“[P]atients infected with resistant strains of key . . . pathogens have increased mortality, longer hospital stays, and higher hospital costs than those infected by [antibiotic] susceptible strains.”).

44. See Brad Spellberg et al., *Trends in Antimicrobial Drug Development: Implications for the Future*, 38 *CLINICAL INFECTIOUS DISEASES* 1279, 1279 (2004).

45. *Id.*

46. See Cars & Nordberg, *supra* note 1, at 4 (2004) (“[M]ortality is repeatedly being shown to be two to three times higher than in infections with non-resistant strains.”).

47. *Id.*

48. GARRETT, *supra* note 9, at 411–13 (noting that once bacteria became resistant to penicillin, doctors started prescribing methicillin, which “increased drug treatment costs for a typical patient approximately tenfold; turning to vancomycin meant turning to one of the most expensive antibiotics on the market.”); Jill U. Adams, *Fewer Respiratory Infections Treated with Antibiotics*, L.A. TIMES, Aug. 31, 2009 (“[A]ntibiotics that are developed to combat resistant bacteria are generally more expensive.”); World Health Organization, Antimicrobial Resistance, <http://www.who.int/mediacentre/factsheets/fs194/en> (last visited Sept. 30, 2009) (“When infections become resistant to first-line antimicrobials, treatment has to be switched to second- or third-line drugs, which are nearly always more expensive.”); cf. George H. Talbot et al., *Bad Bugs Need Drugs: An Update on the Development Pipeline from the Antimicrobial Availability Task Force of the Infectious Diseases Society of America*, 42 *CLINICAL INFECTIOUS DISEASES* 657, 658 (2006) (“[T]he toll of antimicrobial resistance: the loss of thousands of lives and the avoidable cost of billions of health care dollars.”).

49. See HUMANE SOC’Y U.S., AN HSUS REPORT: HUMAN HEALTH IMPLICATIONS OF NON-THERAPEUTIC ANTIBIOTIC USE IN ANIMAL AGRICULTURE 1, 3 (2009), available at <http://www.hsus.org/web-files/PDF/farm/HSUS-Human-Health-Report-on-Antibiotics-in-Animal-Agriculture.pdf> (“[T]housands of patients with *Campylobacter* who sought medical treatment were initially treated with an antibiotic to which the bacteria was resistant, forcing the doctors to switch to more powerful drugs.”); cf. GARRETT, *supra* note 9, at 411–12 (describing how physicians, when faced with resistant strains of *Staphylococcus aureus*, “switched en masse from penicillin to methicillin during the late 1960s”); Steven J. Projan & Patricia A. Bradford, *Late Stage Antibacterial Drugs in the Clinical Pipeline*, 10 *CURRENT OPINION MICROBIOLOGY* 441, 441 (2007) (“In the past physicians could reliably treat such infections with beta-lactam antibiotics, however this is no longer the case.”).

of antibiotics.⁵⁰ Thus, despite the number of antibiotics currently available, “only the development of new classes of antimicrobials with novel mechanisms of action can fully address the burgeoning drug resistance in common pathogens.”⁵¹ Experts fear that if antibiotic resistance continues to rise, antibiotics may become completely obsolete.⁵²

While the need for novel classes of antibiotics is clear, drug developers increasingly choose to research chronic diseases and so-called lifestyle diseases in lieu of developing novel antibiotics. Few novel antibiotics are being developed⁵³ because it has become increasingly expensive to research, develop, and obtain Food and Drug Administration (FDA) approval for novel drugs in general.⁵⁴ In addition to increased research and development costs, antibiotics are less likely to be profitable than drugs that treat chronic diseases.⁵⁵ Unlike drugs for chronic diseases, “antimicrobials are used for very short periods and are used relatively infrequently.”⁵⁶ Bacteria can quickly grow resistant to novel antibiotics and make the antibiotic all but useless, unlike drugs for chronic diseases, which do not become obsolete because of resistance.⁵⁷ Because it takes an average of eight years to introduce a novel drug into the market⁵⁸ and an average of ten years to introduce an antibiotic into the market,⁵⁹ the lack of novel antibiotics cur-

50. For example, antibiotic resistance is often transmitted from one bacteria to another. See Andrew Morris et al., *The Superbugs: Evolution, Dissemination and Fitness*, 1 CURRENT OPINION MICROBIOLOGY 524, 525 (1998). Oftentimes, resistance to more than one antibiotic is transferred. *Id.* Some bacteria can resist multiple types of antibiotics with the same mechanism. See Hiroshi Nikaido, *Multiple Antibiotic Resistance and Efflux*, 1 CURRENT OPINION MICROBIOLOGY 516, 516 (1998).

51. Spellberg et al., *supra* note 44, at 1282.

52. See Robert E.W. Hancock & David Knowles, Editorial Overview, *Are We Approaching the End of the Antibiotic Era?*, 1 CURRENT OPINION MICROBIOLOGY 493 (1998) (“If we do not reverse the current trends by judicious use of existing and new antimicrobial agents, we stand the risk of seeing the antibiotic era as a footnote in human history.”).

53. See, e.g., Aiello et al., *supra* note 11, at 1910 (“Only 2 new classes of antibiotics have been introduced during the past 24 years.”); Katz, *supra* note 11, at 1529 (“[O]ut of the more than 506 drugs in development, only five were new antibiotics. . . . Since 1998, only nine antibiotics or new uses of old antibiotics have been approved by the FDA, and only six antibiotics are in phase 2 or phase 3 clinical trials.”).

54. The estimated cost of developing an approved pharmaceutical agent ranges from \$400 million to \$800 million. Spellberg et al., *supra* note 44, at 1279.

55. See Talbot et al., *supra* note 48, at 657 (“For these larger companies, discovery and clinical development of novel anti-infective agents incurs substantial financial disincentives largely related to the relatively low return on investment that is intrinsic to anti-infective drug development.”).

56. Aiello et al., *supra* note 11, at 1911.

57. *Id.* (“[D]rugs for chronic conditions . . . will not be shelved; consumers can use them for years or decades, and they rarely become ineffective as a consequence of repeated use.”).

58. Spellberg et al., *supra* note 44, at 1282.

59. BAD BUGS, *supra* note 9, at 22.

rently in development means that there will be a continuing shortage of antibiotics.⁶⁰ Furthermore, the market for novel antibiotics is small, especially in comparison to the market for drugs that treat chronic diseases.⁶¹

Many bacterial infections are susceptible to several different antibiotics.⁶² For those infections, older, off-patent, and cheaper antibiotics can effectively fight the infection. Thus, there is no need to use a more expensive novel antibiotic.⁶³ While using off-patent antibiotics conserves novel antibiotics and prevents antibiotic resistance, it reduces the market for novel antibiotics, and thus, it reduces the profit potential of novel antibiotics.

B. *The Patent Term and Patent Prizes*

The term of a U.S. patent, including patents for antibiotics, is twenty years from the date of the patent application.⁶⁴ Currently, there are three statutes that can extend the patent term for certain drugs beyond the twenty-year statutory period or confer a period of market exclusivity: the Hatch-Waxman Act,⁶⁵ the Orphan Drug Act,⁶⁶ and the Best Pharmaceuticals for Children Act.⁶⁷ Recently, proposed legislation sought to extend the patent term for certain in-

60. See Spellberg et al., *supra* note 44, at 1282 (“[T]he decline in antibacterial research and development is [greater than or equal to] one decade old.”).

61. *Id.* at 1279–80 (discussing the factors contributing to the decline in antibiotic development).

62. *Id.*

63. *Id.*

64. The statute states the following:

Subject to the payment of fees under this title, such grant shall be for a term beginning on the date on which the patent issues and ending 20 years from the date on which the application for the patent was filed in the United States or, if the application contains a specific reference to an earlier filed application or applications under section 120, 121, or 365(c) of this title, from the date on which the earliest such application was filed.

35 U.S.C. § 154(a)(2) (2006).

65. Drug Price Competition and Patent Term Restoration Act of 1984, Pub. L. No. 98-417, 98 Stat. 1585 (codified at 21 U.S.C. §§ 355, 360(cc) (2006), 35 U.S.C. §§ 156, 271, 282 (2006)), as amended by Title IX of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, Pub. L. No. 108-173, 117 Stat. 2066 (codified as amended at 21 U.S.C. § 355(j)(5)(C)(i) (2006) and 35 U.S.C. § 271(e)(5) (2006)).

66. Orphan Drug Act, Pub. L. No. 97-414, 96 Stat. 2049 (1983) (codified as amended at 21 U.S.C. § 360aa-ee (1998)).

67. Pub. L. No. 107-109, 115 Stat. 1408 (codified as amended in scattered sections of 21 U.S.C. and 42 U.S.C.).

ventions that relate to bioterrorism and infectious disease outbreaks,⁶⁸ but those legislative bills were not enacted into law.⁶⁹

The Drug Price Competition and Patent Term Restoration Act, also known as the Hatch-Waxman Act, was enacted in 1984.⁷⁰ Under the Act, if a patented drug's entry into the market is delayed by FDA regulatory review, the time lost is restored to the patent term.⁷¹ The time period that can be restored under the Hatch-Waxman Act is subject to two limitations: (1) the amount of time added to the patent cannot exceed five years,⁷² and (2) the total amount of time remaining on the patent cannot exceed fourteen years.⁷³ Although the Hatch-Waxman Act was enacted in 1984, its patent provisions did not begin to apply to antibiotics until 1997.⁷⁴ Research demonstrates that the Hatch-Waxman Act has not resulted in increased research and development of novel antibiotics.⁷⁵

The Orphan Drug Act grants a seven-year period of market exclusivity and tax credits to the developer of a drug that treats a rare dis-

68. See Protecting America in the War on Terror Act of 2005, S. 3, 109th Cong. (2005); S. 975, 109th Cong. § 301 (2005).

69. See <http://govtrack.us/congress/bill.xpd?bill=s109-3> (last visited Aug. 5, 2009) (indicating that S. 3 never became law); <http://govtrack.us/congress/bill.xpd?bill=s109-975> (last visited Aug. 5, 2009) (indicating that S. 975 never became law).

70. See Gerald J. Mossinghoff, *Overview of the Hatch-Waxman Act and Its Impact on the Drug Development Process*, 54 FOOD & DRUG L.J. 187, 188 (1999).

71. "The term of a patent eligible for extension under subsection (a) shall be extended by the time equal to the regulatory review period for the approved product which period occurs after the date the patent is issued" 35 U.S.C. § 156(c) (2006).

72. 35 U.S.C. § 156(g)(6)(A) (2006) ("[T]he period of extension determined on the basis of the regulatory review period determined under any such paragraph may not exceed five years.").

73. For example, if the patent term has eleven years left to run and the patent would otherwise be entitled to a four-year patent term restoration under the Hatch-Waxman Act, the patent could only receive a three-year patent term restoration. *Id.*

74. Prior to the passage of the Food and Drug Administration Modernization Act of 1997 (FDAMA), Pub. L. No. 105-115, antibiotics were treated differently during regulation by the FDA.

Prior to FDAMA, antibiotics were approved under § 507 of FDCA, Pub. L. No. 105-155, 111 Stat. 2327 (1997), and most other drugs were approved under § 505 of the FDCA. Drugs approved under § 505 were eligible for the data and patent protections provided by Hatch-Waxman FDAMA eliminated this distinction for antibiotics and other drugs approved after its effective date, Nov. 21, 1997.

Gregory J. Glover, *Boosting Innovation in Antibiotics*, NAT'L L.J., Dec. 1, 2008, at 1, 2, available at <http://www.pharmalawgrp.com/pdf/National%20Law%20Journal.pdf>; see also Julie Dohm, *Expanding the Scope of the Hatch-Waxman Act's Patent Carve-Out Exception to the Identical Drug Labeling Requirement: Closing the Patent Litigation Loophole*, 156 U. PA. L. REV. 151, 165 (2007) ("In 1997, Congress repealed section 507 and subjected antibiotic drug approvals to section 505 of the FDCA. This revision made antibiotics eligible, for the first time, for section 505's patent and nonexclusivity provisions.").

75. See Aiello, *supra* note 11, at 1910 ("[D]evelopment of new classes of antimicrobials has been at a virtual standstill since the late 1970s.").

ease.⁷⁶ The Act was deemed necessary because existing financial incentives were insufficient to encourage the development of drugs that treat rare diseases.⁷⁷ This Act could be used to encourage the development of an antibiotic for relatively rare bacterial infections or antibiotic-resistant bacterial infections that affect fewer than 200,000. Likewise, the Act could encourage the development of antibiotics when a developer cannot expect to recoup its investment. Unfortunately, few antibiotic developers have utilized this Act, which suggests that the Act does not adequately encourage research and development into novel antibiotics.⁷⁸

In 2002, Congress enacted the Best Pharmaceuticals for Children Act (BPCA) to encourage pharmaceutical companies to test the safety and reliability of their drugs for children.⁷⁹ The BPCA grants a six-month patent term extension to a complying pharmaceutical company.⁸⁰ In order for a patentee to qualify for an extension, the FDA must determine that pediatric research for the effects of the drug would be beneficial.⁸¹ If the patentee agrees to perform a pediatric study within a specified time period, the patentee receives the six-month extension.⁸² The BCPA was reenacted in 2007.⁸³

In 2005, two bills—the Protecting America in the War on Terror Act of 2005 and the Project BioShield II Act of 2005—proposed the extension of the drug patent term for some drugs; neither of the Acts

76. The Orphan Drug Act, 21 U.S.C. § 360cc(a) (2006), states the following:

[I]f the Secretary—

(1) approves an application filed pursuant to section 355 of this title, or
(2) issues a license under section 262 of Title 42 for a drug designated under section 360bb of this title for a rare disease or condition, the Secretary may not approve another application under section 355 of this title or issue another license under section 262 of Title 42 for such drug for such disease or condition for a person who is not the holder of such approved application or of such license until the expiration of seven years from the date of the approval of the approved application or the issuance of the license.

77. OOPD Program Overview, <http://www.fda.gov/orphan/progovw.htm> (last visited Aug. 10, 2009).

78. A search of the drugs designated as “orphan drugs” by the FDA via its website, <http://www.accessdata.fda.gov/scripts/opdlisting/oopd/index.cfm>, returned two drugs under the search term “antibiotic” and two drugs under the term “antimicrobial.” “Antibiotic” and “antimicrobial” were searched under “Orphan Designation” by applying the earliest possible start date (January 1, 1983) and an end date of August 16, 2009. A search for all orphan drug designations for the same date range (i.e., not restricting by “Orphan Designation”) returned 2,034 drugs.

79. Lisa Jerles, Note, *The Best Pharmaceuticals for Children Act and the Pediatric Research Equity Act—Helping or Hurting America’s Children?*, 6 CARDOZO PUB. L. POL’Y & ETHICS J. 515, 516–17 (2008).

80. *Id.* at 518.

81. *Id.* at 518.

82. *Id.*

83. *Id.* at 519.

were enacted.⁸⁴ Senator Judd Gregg introduced the Protecting America in the War on Terror Act.⁸⁵ The legislation aimed to improve the United States' ability to counter bioterrorism,⁸⁶ and it included a provision intended to "provide patent incentives to certain entities to protect inventions from expropriation by competitors and to provide an incentive for capital formation to fund countermeasures and vaccine research."⁸⁷ The bill also proposed the granting of patent term extensions that equaled the number of days that successful counter-bioterrorism measures spent in regulatory review.⁸⁸ Additionally, the bill included a provision that grants a two-year patent term extension.⁸⁹ However, the legislative language is unclear as to whether the extension would be applied specifically to the qualifying countermeasure or whether the pharmaceutical company could apply the extension to a different drug.⁹⁰ While antibiotics that target resistant bacteria are not specifically mentioned as a potential countermeasure, these antibiotics would likely be eligible.⁹¹ The Senate did not take any action on this bill.⁹²

Likewise, Senator Joseph Lieberman introduced the Project BioShield II Act of 2005.⁹³ This bill aimed to encourage research that could lead to the development of countermeasures against biological, chemical, nuclear, and radiological weapons, as well as infectious disease outbreaks.⁹⁴ Part of the proposed legislation encouraged re-

84. See Office Legislative Pol'y & Analysis, Legislative Updates, <http://olpa.od.nih.gov/legislation/109/pendinglegislation/bioterror.asp> (last visited Aug. 16, 2009).

85. See S. 3, 109th Cong. (2005).

86. *Id.*

87. *Id.* § 113(a).

88. *Id.* § 113(c); see Jeffrey Light, *BioShield II Proposal Would Hurt Seniors, Uninsured in the Name of Homeland Security*, PATIENTS NOT PATENTS, Sept. 20, 2005, <http://www.patientsnotpatents.org/bioshield2.htm> (last visited Aug. 16, 2009) (describing how the bill would eliminate the five-year cap on a patent term restoration for time lost in regulatory review).

89. *Id.* § 113(d) ("In no case shall any extension granted under this section exceed 2 years, or be less than 6 months.").

90. "Proponents . . . have asserted that the controversial wild card provision has been dropped from their version of the bill." Light, *supra* note 88. However, "it's hard to predict which way a court would interpret the provision" *Id.*

91. Senator Lieberman mentioned antibiotic-resistant bacteria as a bioterrorism threat during committee hearings on the bill. See *Creating a BioDefense Industry: BioShield II, Hearing on S. 975 Before the S. Comms. on the Judiciary and Health, Education, Labor & Pensions*, 109th Cong. (Oct. 6, 2004) (testimony of Senator Joseph Lieberman) ("The Soviets apparently developed a strain of plague resistant to ten different antibiotics, and a strain of anthrax resistant to seven different antibiotics."). Thus, an antibiotic that treats antibiotic-resistant infections could be considered a countermeasure within the meaning of the legislation.

92. See <http://govtrack.us/congress/bill.xpd?bill=s109-975> (last visited Aug. 16, 2009) (indicating that S. 975 never became law).

93. S. 975, 109th Cong. § 301 (2005).

94. *Id.*

search via a “wild-card” patent term extension.⁹⁵ Under this proposal, the patent holder for a novel antibiotic or counterterrorism agent would receive a patent term extension that could be applied either to the antibiotic, the counterterrorism agent, or any other patent held by the patent owner.⁹⁶ The pharmaceutical company would contract with the Department of Health and Human Services to develop the drug in exchange for the patent term extension.⁹⁷ Thus, a pharmaceutical company that successfully produced an antibiotic or counterterrorism agent could apply the wild-card patent term extension to a patent of its choice, such as a blockbuster drug.⁹⁸ The wild-card patent term extension would last from three months to two years.⁹⁹

A hearing was held on the bill in July 2005.¹⁰⁰ Generic pharmaceutical companies, fearful of the impact that a wild-card patent term extension would have on their ability to market and sell generic drugs, lobbied against the wild-card patent term extension provision of Project BioShield II.¹⁰¹ The companies argued that such measures would “only delay consumers’ access to affordable medicines.”¹⁰² Representative Henry Waxman also argued that the provision would allow a pharmaceutical company to extend the patent of a blockbuster drug for two years as a result of developing a “third-line treatment of a minor side effect of an anthrax vaccine.”¹⁰³ After the initial hearing, no further action was taken on the bill.¹⁰⁴ A similar bill was introduced in 2006 that omitted a wild-card extension.¹⁰⁵

95. Spellberg et al., *supra* note 5, at 167.

96. *Id.*

97. See *Preparing a National Biodefense: Hearing on S. 975 Before the S. Comm. on Health, Education, Labor & Pensions*, 109th Cong. (statement of Sen. Lieberman) (“At some point the Secretary of [the Department of Health and Human Services] will say, OK, what are you working on with regard to a countermeasure for a bioterrorist But you only get the patent bonus if the countermeasure, an effective countermeasure is delivered.”).

98. *Id.*

99. *Id.*

100. *Id.*

101. See Press Release, Generic Pharm. Ass’n, GPhA: New Bioterrorism Bill Would Bust Health Care Budgets, http://www.prnewswire.com/cgi-bin/micro_stories.pl?ACCT=913120&TICK=GPHA&STORY=/sww/story/04-29-2005/0003494723&EDATE=apr+29,+2005. (last visited Oct. 1, 2008).

102. *Id.*

103. *Generic Pharmaceutical Companies Oppose Proposed Amendment to BioShield II Legislation*, USA, MED. NEWS TODAY, Mar. 1, 2005, <http://www.medicalnewstoday.com/articles/20494.php>. (last visited Oct. 15, 2008).

104. See <http://govtrack.us/congress/bill.xpd?bill=s109-975> (last visited Oct. 15, 2008). A similar bill, S. 2564, was introduced in 2006 that omitted a wild-card extension, but no action was taken on S. 2564 after it was referred to committee. S. 2564, 109th Cong. (2006); RAMANAN LAXMINARAYAN & ANUP MALANI, *EXTENDING THE CURE* 148 (2007); <http://www.govtrack.us/congress/bill.xpd?bill=s109-2564> (last visited Nov. 22, 2009).

105. S. 2564, 109th Cong. (2006); LAXMINARAYAN & MALANI, *supra* note 104, at 148.

In addition to the two patent term extension proposals discussed above, Senator Bernie Sanders introduced the Medical Innovation Prize Act of 2007.¹⁰⁶ The bill proposed that a drug developer receive a cash reward for a medical innovation in lieu of the traditional patent monopoly right.¹⁰⁷ Congress never acted upon this bill.¹⁰⁸

In conclusion, antibiotic resistance is a serious and growing problem. As bacteria can quickly evolve to combat the antibiotics used to fight the bacteria, the widespread use of antibiotics causes antibiotic resistance, and the overuse of antibiotics exacerbates it. While the rise in antibiotic resistance has accentuated the need for novel antibiotics that can effectively treat antibiotic-resistant infections, the development of such novel antibiotics has stagnated, as antibiotic development offers little profit potential in comparison to drugs that treat chronic illnesses.

The Hatch-Waxman Act, the Orphan Drug Act, and the Best Pharmaceuticals for Children Act do not specifically reward or encourage antibiotic development. Recent legislation sought to encourage the development of certain types of drugs and countermeasures—including antibiotics—via extending the patent term for the countermeasure or drug, extending the patent term of another patent owned by the pharmaceutical company that developed the drug or counter measure, or by offering a patent prize in lieu of a typical patent term. As will be discussed, these proposals would not likely work because altering patent law is not the way to encourage antibiotic development.

III. ANALYSIS

This Part analyzes the problems associated with using the patent system to prevent antibiotic resistance and to encourage the development of novel antibiotics. This Part also addresses the probable effects of recent proposals that extend the patent term or institute a patent prize system. Section A analyzes the patent bargain's relationship to antibiotic resistance, and it explains how the patent term undermines efforts to minimize antibiotic resistance.¹⁰⁹ Section B discusses and critiques recent patent law modifications that were in-

106. S. 2210, 110th Cong. (2007).

107. See Knowledge Ecology Int'l, *Experts Comment on Senate Bill that Replaces Monopolies for Medicines with System of Prizes*, KEI ONLINE, Oct. 19, 2007, http://www.keionline.org/index.php?option=com_content&task=view&id=150 (last visited Jan. 12, 2009) [hereinafter *Experts Comment*].

108. See <http://www.govtrack.us/congress/bill.xpd?bill=s110-2210> (last visited Nov. 10 2008).

109. See *infra* notes 112–135 and accompanying text

tended to prevent antibiotic resistance and encourage novel antibiotic development.¹¹⁰ Section C examines the incompatibility of the patent law system with the the scientifically optimal methods that limit and prevent antibiotic resistance.¹¹¹

A. *Patent Law and Antibiotic Resistance*

Patent law exacerbates the problems of antibiotic resistance for the following reasons: (1) the patent bargain does not function effectively with respect to antibiotics, (2) the antibiotic developer has little incentive to minimize antibiotic resistance, and (3) the patent term itself is incompatible with the optimal use of antibiotics.

1. *The Patent Bargain and Antibiotic Resistance*

The patent bargain affects antibiotics differently than other inventions. The patent system is predicated on a quid pro quo between an inventor and society.¹¹² To illustrate, the inventor discloses his invention to the public, and in exchange, the government grants the inventor a limited period of market exclusivity for the invention.¹¹³ The public benefits from the disclosure once the patent application is published,¹¹⁴ and it benefits from the invention itself after the patent term has expired. However, bacteria can quickly grow resistant to antibiotics,¹¹⁵ and it may even become resistant before the antibiotic patent

110. See *infra* notes 136–237 and accompanying text.

111. See *infra* notes 245–264 and accompanying text.

112. See Andrew W. Torrance, *An Extinction Bar to Patentability*, 20 GEO. INT'L ENVTL. L. REV. 237, 238 (2008). Torrance notes,

At the heart of the patent bargain lies a vital quid pro quo: in return for granting a patentee a limited monopoly right to exclude others from making, using, selling, offering to sell, or importing a patentee's claimed invention, the patent must provide the public with new and useful information

Id.

113. See Andrew W. Torrance, *Patents to the Rescue—Disasters and Patent Law*, 10 DEPAUL J. HEALTH CARE L. 309, 312 (2007) (“To justify receipt of monopoly rights in an invention an inventor must provide society with full disclosure of that invention to ‘add to society’s storehouse [of knowledge].’”) (quoting *In re Argoudelis*, 434 F.2d 1390, 1394 (C.C.P.A. 1970) (Baldwin, J., concurring)).

114. Patent applications are typically published eighteen months after filing. Press Release, United States Patent & Trademark Office, UPSTO Will Begin Publishing Patent Applications, Nov. 27, 2000, available at <http://www.uspto.gov/web/offices/com/speeches/00-72.htm>. (last visited Jan. 10, 2009).

115. One species of bacteria, *Neisseria gonorrhoeae*, was once effectively treated by an antibiotic. Nine years after the antibiotic became widely used, antibiotic-resistant strains became increasingly common. See Susan A. Wang et al., *Antibiotic Resistance for Neisseria gonorrhoeae, 1988 to 2003: The Spread of Fluoroquinolone Resistance*, 147 ANNALS OF INTERNAL MED. 81, 81 (2007).

expires.¹¹⁶ If the antibiotic is ineffective by the time the patent expires, the public might not reap the benefit of the invention.

However, it is possible that an antibiotic may benefit the public even if the antibiotic is ineffective when the patent expires because the inventor's disclosure may lead to the development of future generations of antibiotics.¹¹⁷ Future generation antibiotics can be valuable because they may be more effective against a wider spectrum of bacteria than the first generation antibiotic.¹¹⁸ Unfortunately, bacteria that are resistant to a first generation antibiotic will often also be resistant to future generation antibiotics.¹¹⁹ Therefore, a pharmaceutical company would be unlikely to invest in the development of future generation antibiotics because they may quickly become ineffective and unprofitable if bacteria are resistant to the first generation antibiotic.¹²⁰ If this occurs, the public does not reap the benefit of the inventor's disclosure because the first generation antibiotic is ineffective, and the public loses the opportunity to get a safer, more effective future generation antibiotic. Some experts believe that there is a finite number of antibiotics available in nature.¹²¹ If so, the pharmaceutical company's refusal to invest in future generation antibiotics deprives the public of one of a limited number of antibiotics.

2. *The Patent Term is Incompatible with the Optimal Use of Antibiotics*

The antibiotic developer, often a private corporation, has an incentive to maximize its economic benefit despite any negative effect on antibiotic resistance.¹²² Because the patent term is set at twenty years

116. Resistance can become widespread in as little as nine years. *See id.* If the novel antibiotic is used to treat bacterial infections soon after the antibiotic is developed, and if resistance begins to develop immediately, and if the patent is applied for at the time it was developed, then bacteria may become resistant within nine years after applying for the patent. Thus, resistance would develop even before the basic twenty-year statutory patent term expires.

117. *See* Spellberg et al., *supra* note 44, at 1282 (discussing the advantages of developing new drugs within an existing class).

118. "The development of new drugs within an existing class may also provide incremental improvement in antimicrobial spectrum . . ." *Id.*

119. *Cf.* Outterson, *supra* note 25, at 96 ("Class resistance also weakens future members of the class still in the drug development pipeline.").

120. "The more rapidly pathogens develop resistance and thus render new drugs ineffective, the smaller the potential market for those drugs." Aiello et al., *supra* note 11, at 1911. If the first generation antibiotic is ineffective because of antibiotic resistance and the next generation antibiotic would likely also be ineffective because of antibiotic resistance, there would be a very small potential market for the next generation antibiotic, and the antibiotic would be unprofitable.

121. *See* Outterson, *supra* note 25, at 68 ("Some pharmaceutical knowledge is therefore exhaustible . . .").

122. *Id.* at 84.

from the date that the patent application was filed, the antibiotic developer has a limited period of time to profit from the antibiotic, let alone to recoup the expenses from research and commercialization. To profit from an antibiotic, the developer would likely market the drug immediately upon FDA approval and heavily advertise the drug to promote its use. These actions are likely to contribute to antibiotic resistance. Marketing the antibiotic immediately upon FDA approval gives the developer the most time to profit within the limited patent term.¹²³ However, from a public health perspective, the best way to utilize a novel antibiotic may be to delay its use until existing antibiotics are no longer effective.¹²⁴ Nonetheless, the developer is financially motivated to market the drug immediately, in part because of the limited patent term.¹²⁵ While widespread use of an antibiotic maximizes profit, the overuse of antibiotics is one of the main causes of antibiotic resistance.¹²⁶ Thus, in attempting to maximize profit, the antibiotic developer encourages the overuse of the antibiotic and increases the likelihood of antibiotic resistance.

An antibiotic developer should be encouraged to prevent antibiotic resistance. However, the patent term discourages developers from combating antibiotic resistance.¹²⁷ The developer will not be able to maximize profit from the antibiotic once the patent has expired because generic competition drives down the price of the antibiotic.¹²⁸ Accordingly, the developer has no incentive to ensure that the antibi-

123. *Id.* at 83–84.

124. See *id.* at 83 for a discussion of Pfizer's decision to bring dalbavancin, a new antibiotic, to market immediately upon the drug's FDA approval, even though "best medical practices might shelve dalbavancin for a long period of time until the social need is more compelling."

125. *Id.*

126. See Dan I. Andersson & Bruce R. Levin, *The Biological Cost of Antibiotic Resistance*, 2 CURRENT OPINION MICROBIOLOGY 489, 489 (1999) ("[T]he evolution and spread of resistance can be attributed to the use and overuse of antibiotics . . ."); Ron Dagan et al., *Will Reduction of Antibiotic Use Reduce Antibiotic Resistance?*, 25 PEDIATRIC INFECTIOUS DISEASE J. 981, 981 (2006) ("Antimicrobial drug use and abuse is a major contributor to the emergence of resistance in respiratory pathogens."); Mainous et al., *supra* note 10, at 22 ("Overuse of antibiotics has been linked to rates of antibiotic resistance.").

127. See Outterson, *supra* note 25, at 81 (analogizing the waste that is likely to occur when a limited time period exists on a lease of real property to the waste that occurs from a limited patent term).

128. See John B. Horowitz & H. Brian Hoehring, *How Property Rights and Patents Affect Antibiotic Resistance*, 13 HEALTH ECON. 575, 580 (2004) ("Antibiotic resistance tends to increase when a patent on an antibiotic expires. Since new companies can now produce and distribute the antibiotic, more of the antibiotic is produced and prices fall."); Outterson, *supra* note 25, at 82–83 (explaining that Pfizer plans to bring a novel antibiotic to market sooner than may be socially beneficial because Pfizer's patent for Zithromax, a blockbuster antibiotic, is expiring soon).

otic is useful in the long run.¹²⁹ While it would be in the public's interest to encourage the conservation of novel antibiotics, it is not in the antibiotic developer's financial interest to encourage conservation during the patent term.¹³⁰

For some bacteria, such as extremely drug-resistant tuberculosis¹³¹ and vancomycin-resistant *Enterococcus*,¹³² few if any antibiotics are effective.¹³³ If a pharmaceutical company developed an antibiotic that was effective against these bacteria, it would be most beneficial from a public health perspective to "save" the antibiotic for these infections and not to use it on bacteria that can be effectively treated by other antibiotics.¹³⁴ However, the pharmaceutical company has no incentive to save the antibiotic for these extremely resistant infections. If the antibiotic is effective against a wide spectrum of bacteria and if it is easy to administer and tolerate, the pharmaceutical company would profit by promoting its extensive use.¹³⁵

B. *Altering Patent Law is Unlikely to Solve the Problems of Antibiotic Resistance*

There are two ways to approach the problem of antibiotic resistance: (1) stimulate research and development of novel antibiotics, and (2) conserve antibiotics.¹³⁶ Both strategies need to be imple-

129. *Id.* at 82.

130. *Id.* at 83–84.

131. See Mario Raviglione, Editorial, *XDR-TB: Entering the Post-Antibiotic Era?*, 10 INT'L J. TUBERCULOSIS LUNG DISEASES 1185, 1185 (2006).

132. See Steven J. Brickner & Shahriar Mobashery, *Prospects of Therapies Targeting Resistant Bacteria—New Challenges 20 Years Post Emergence of Vancomycin-Resistant Enterococcus*, 10 CURRENT OPINION MICROBIOLOGY 425, 425 (2007) (“[V]ancomycin-resistant enterococcus] cause difficult-to-treat and often life-threatening infections . . .”).

133. See *id.* (“[M]edical practitioners have increasingly come to encounter more significant treatment challenges brought on by the rising incidence of . . . problematic multi-drug resistant infections . . .”); Projan & Bradford, *supra* note 49, at 441 (2007) (“In fact, untreatable, pan-resistant bacterial infections do occur and are becoming increasingly common.”).

134. See Outterson, *supra* note 25, at 83 (discussing Pfizer's decision to market a new antibiotic, dalbavancin, immediately upon FDA approval, even though “best medical practices might shelve dalbavancin for a long period of time until the social need is more compelling.”); cf. BAD BUGS, *supra* note 9, at 17 (“[I]nfectious disease physicians and other public health experts often hold new antibiotics in reserve, hoping to avoid fostering the rapid emergence of resistant bacteria and saving them for when they are most needed.”).

135. See *id.* at 84, discussing Tygacil/tigacycline, a “novel, wide spectrum antibiotic,” and Wyeth, the antibiotic developer of Tygacil/tigacycline, as well as Wyeth's “difficult choice between pressures to market Tygacil aggressively and the clinical demands of global EPK conservation.” Outterson further notes that “[t]he best medical approach for tigeacycline might be to hold it completely off the market for many years, except for true emergency situations where no other drug would work. Expecting Wyeth to do so voluntarily seems too much.” *Id.*

136. See *id.* at 68.

mented in order to combat antibiotic resistance.¹³⁷ Recent proposals to stall antibiotic resistance include: (1) extending the patent term for antibiotics,¹³⁸ (2) granting a wild-card patent term extension to the developer of a novel drug,¹³⁹ and (3) awarding a monetary “prize” to the developer of a novel antibiotic in lieu of the traditional patent right of exclusivity.¹⁴⁰

1. *Extending the Patent Term*

Laws such as the Hatch-Waxman Act¹⁴¹ and the Best Pharmaceuticals for Children Act¹⁴² allow the extension of the patent term for pharmaceutical inventions in certain circumstances. Commentators have suggested that extending the patent term for antibiotics may encourage pharmaceuticals to conserve antibiotic efficacy.¹⁴³ However, this Section argues to the contrary.¹⁴⁴

a. Previous Laws Extending the Patent Term Have Not Resulted in Increased Antibiotic Development

Both the Hatch-Waxman Act and the BPCA lengthen the patent term for certain pharmaceutical patents,¹⁴⁵ while the Orphan Drug Act grants a seven-year market exclusivity for a qualifying drug.¹⁴⁶ These Acts do not differentiate between antibiotics and other types of drugs.¹⁴⁷ Since the passage of the Hatch-Waxman Act and the Orphan Drug Act, antibiotic development has slowed dramatically¹⁴⁸ be-

137. *Id.* at 68–69.

138. See Eric Kades, *Preserving a Precious Resource: Rationalizing the Use of Antibiotics*, 99 *Nw. U. L. Rev.* 611, 652 (2005).

139. See Spellberg et al., *supra* note 5, at 167.

140. See *Experts Comment*, *supra* note 106.

141. 35 U.S.C. § 154(a)(2) (2006).

142. 21 U.S.C. § 355(i) (2006).

143. Kades, *supra* note 138, at 646.

144. See *infra* notes 155–157 and accompanying text.

145. See *supra* notes 70–75, 79–83 and accompanying text.

146. See *supra* note 76 and accompanying text.

147. See 21 U.S.C. § 355A(b)(1) (instructing the Secretary to make a written request for pediatric studies if “information relating to the use of a new drug in the pediatric population may produce health benefits in that population” without distinguishing between antibiotics and other drugs); 21 U.S.C. § 360bb (defining a “rare disease or condition” under the Orphan Drug Act as “any disease or condition which (A) affects less than 200,000 persons in the United States, or (B) affects more than 200,000 and for which there is no reasonable expectation that the cost of developing and making available in the United States a drug for such disease or condition will be recovered from sales in the United States of such drug,” the definition of which does not distinguish between antibiotics and other drugs); Glover, *supra* note 74, at 2 (explaining that the “FDAMA eliminated th[e] distinction between antibiotics and other drugs” in Hatch-Waxman provision eligibility).

148. See *supra* notes 75, 78 and accompanying text.

cause antibiotics “produce a weak return on investment for manufacturers”¹⁴⁹ in comparison to other types of drugs. Because the Hatch Waxman Act and the Orphan Drug Act do not differentiate between antibiotics and other drugs,¹⁵⁰ they offer no incentive to develop antibiotics in lieu of, or in addition to, more profitable drugs.

However, the BPCA has successfully encouraged pharmaceutical companies to conduct pediatric tests.¹⁵¹ The studies conducted under the BPCA demonstrated the different effects that drugs have on children,¹⁵² and they resulted in valuable labeling changes.¹⁵³ Pediatric drug testing may be particularly important for antibiotics because bacterial infections disproportionately affect young children.¹⁵⁴ While such testing may be worthwhile, it would not spur additional antibiotic development because it is designed to encourage testing drugs for children, rather than developing new drugs.

b. Extending the Patent Term for Antibiotics is Unlikely to Encourage Conservation

Bacteria can develop resistance to antibiotics very quickly.¹⁵⁵ Many bacteria develop resistance in time periods of less than the twenty-year statutory patent term.¹⁵⁶ Thus, an antibiotic may be ineffective before the statutory patent term expires.¹⁵⁷ Therefore, a patent term extension would have little economic value to an antibiotic developer, and a patent term extension is highly unlikely to encourage the development of novel antibiotics.

149. BAD BUGS, *supra* note 9, at 16.

150. See *supra* note 147 and accompanying text.

151. See Krista Conger, *What Would Goldilocks Do?*, 22 STAN. MED. MAG. 18, 20–21 (2005).

152. See U.S. GEN. ACCOUNTING OFFICE, PEDIATRIC DRUG RESEARCH: STUDIES CONDUCTED UNDER BEST PHARMACEUTICALS FOR CHILDREN ACT 16 (2007), available at <http://www.gao.gov/new.items/d07557.pdf> (last visited July 10, 2009) (“Pediatric drug studies conducted under BPCA showed that children may have been exposed to ineffective drugs, ineffective dosing, overdosing, or side effects that were previously unknown.”).

153. *Id.*

154. See Naushaba Degani et al., *Invasive Bacterial Diseases in Northern Canada*, 14 EMERGING INFECTIOUS DISEASES 34, 37 (2008).

155. See Aiello et al., *supra* note 11, at 2 ([Methicillin-resistant *Staphylococcus aureus*] in particular has exhibited a “stealth” ability to quickly adapt and acquire new antibiotic resistance traits.); Wang et al., *supra* note 115, at 81.

156. *Neisseria gonorrhoeae* developed antibiotic resistance in nine years. *Id.*

157. Exposure to an antibiotic in pre-clinical and clinical testing creates a selective pressure on bacteria to resist the antibiotic. See Mainous, *supra* note 10, at 28 (discussing how the use of antibiotics creates a selective pressure that contributes to resistance). Because this selective pressure begins when bacteria are exposed to the antibiotic, bacteria may start developing resistance once such testing begins, which often occurs near the beginning of the patent term. See BAD BUGS, *supra* note 9, at 19 (“Most patents are filed during the pre-clinical phase [of research and development].”).

Commentators, such as Eric Kades, have suggested that extending the patent term may encourage antibiotic conservation.¹⁵⁸ Kades believes that if antibiotic patents had longer terms, pharmaceutical companies would be likely to promote antibiotic conservation so that the antibiotic remains effective for a longer time.¹⁵⁹ Kades assumes that an antibiotic developer would “initially price the good higher than optimal, and will stretch out the useful life of the resource.”¹⁶⁰ However, even if this assumption were true, a pharmaceutical company may be more concerned with its short-term financial health than long-term financial possibilities, in which case it “might still be tempted to sell more now rather than later.”¹⁶¹ Thus, even if a longer patent term could result in a long-term financial benefit, that benefit may be insufficient to encourage conservation. Furthermore, bacteria can develop resistance quickly, even if the antibiotic is carefully conserved.¹⁶² If the antibiotic becomes ineffective before the original patent term expires, the pharmaceutical company will not financially benefit from either the patent extension or the antibiotic’s conservation.

c. Additional Problems with Extending Patent Terms

Altering patent law would pose additional problems to improving healthcare for those suffering from antibiotic-resistant infections, even if it were an effective means of conserving antibiotics. A longer patent term results in a longer period of market exclusivity for the patentee.¹⁶³ Thus, potential competitors would be unable to market any product involving the patented technology until that longer patent term expired, and a potential competitor would be discouraged from researching the patented technology until a later time.¹⁶⁴ Theoreti-

158. See Kades, *supra* note 138, at 652.

159. *Id.*

160. *Id.* Kades’ argument continues,

For antibiotics, this means that a monopolist will price out of the market some moderate-value consumers, such as a patient with a painful but not serious bacterial infection. This is the cost of monopoly. The benefit is that the patent holder will maintain the utility of the drug for a longer-than-optimal time. If society is risk-averse, this is an attractive trade-off. Granting antibiotic inventors very long-term patents trades off some short-term moderate pain in return for ensuring the ability to treat the most serious illnesses further into the future.

Id.

161. Outterson, *supra* note 25, at 104.

162. See Brickner & Mobashery, *supra* note 132, at 425.

163. See Kades, *supra* note 138, at 644–46.

164. Under the statutory “experimental use” exception, a pharmaceutical company may conduct research on a patented drug without liability to the patentee, so long as that research is reasonably related to the “development and submission of information under . . . Federal law.” *Merck KGaA v. Integra Lifesciences I, Ltd.*, 545 U.S. 193, 202 (2005) (citing 35 U.S.C.

cally, research would lead to future generation antibiotics that are safer and more effective than the first generation antibiotic.¹⁶⁵ However, if potential competitors cannot market any improvement of the antibiotic until the extended patent term expires, potential competitors would be unlikely to research such improvements until the patented time was coming to an end.

In addition to discouraging further research, extending the patent term would also place a burden on those who need the affordable generic antibiotics that are produced after the patent term expires because many people in the United States lack financial access to expensive drugs.¹⁶⁶ Many people around the world would also be adversely affected by long patent terms.¹⁶⁷ For example, pharmaceutical companies that are concerned about the therapeutic effectiveness of their patent-protected antibiotics have demonstrated a reticence to donate or reduce the prices of antibiotics below the marginal cost of production for those in developing nations.¹⁶⁸ Thus, if the patent term was extended, these people would lack access to those antibiotics for an even longer period of time.¹⁶⁹

Moreover, if a patent term extension would effectively prompt pharmaceutical companies to develop novel antibiotics, there would be many additional adverse effects. Generic pharmaceutical companies would be unable to sell generic versions of the patented drug during the patent term extension period. Without competition from generic pharmaceutical companies, the antibiotic developer would charge more for the patented drugs.¹⁷⁰ Insurance companies would bear the additional costs of covering the expensive brand name drugs for an extended period, and they would pass on the increased costs to consumers via increased fees, deductibles, and co-pays. Ultimately, the public would pay the price for patent term extensions.

§ 271(e)(1) (2000)) (noting that the statutory experimental use exception applies to tests that are required for FDA approval, as well as pre-clinical tests, both of which may be submitted for FDA approval even though submission is not required).

165. See Spellberg et al., *supra* note 44, at 1282.

166. Peter J. Cunningham, *Affording Prescription Drugs: Not Just a Problem for the Elderly* 4 (Ctr. for Studying Health System Change, Research Report No. 5, 2002), available at <http://www.hschange.org/CONTENT/430/430.pdf> (“About 23 million American adults—or 12 percent of the adult population—could not afford to get at least one prescription medication in the past year,”); see *id.* at 10 (“[P]olicymakers should not ignore the difficulties that many nonelderly adults have in affording prescription medications.”).

167. See Outterson, *supra* note 25, at 87–88.

168. *Id.* at 87–88.

169. *Id.* at 73.

170. In fact, this is the reason that patent term extensions would encourage pharmaceutical companies to develop novel antibiotics.

2. *Wild-Card Patent Term Extensions*

A wild-card patent term extension would allow the pharmaceutical company to apply a patent term extension to any of its patented pharmaceuticals.¹⁷¹ The Project BioShield II Act of 2005 attempted to use a wild-card patent term extension to encourage pharmaceutical companies to develop products that counter terrorism.¹⁷² Some commentators argued that this wild-card patent term extension would result in long-term societal savings of approximately \$4.6 billion¹⁷³ because antibiotic-susceptible infections are less expensive to treat than antibiotic-resistant infections.¹⁷⁴ However, a wild-card patent term extension may not save society as much as predicted. Suggested modifications of wild-card patent term proposals may not prove effective, and they may actually do more harm than good.

a. Society Is Unlikely to Save Money from a Wild-Card Patent Term Extension

In his 2004 article, Brad Spellberg predicts that wild-card patent term extensions would save society money. His predictions are based on a hypothetical novel drug that could treat drug-resistant *Pseudomonas aeruginosa*, one particular bacterium.¹⁷⁵ Spellberg bases his calculations on a hypothetical new antibiotic that would reduce the cost of antibiotic-resistant infection by fifty percent.¹⁷⁶ However, the actual savings that would result from such an antibiotic are unclear.¹⁷⁷ For example, strains resistant to current antibiotics may also be resistant to the novel antibiotic.¹⁷⁸ In that case, there would be no societal benefit to the novel antibiotic because the novel antibiotic would not effectively treat the resistant infection.¹⁷⁹ In addition, Spellberg estimates that a wild-card patent extension would be cost-

171. See Spellberg et al., *supra* note 5, at 167.

172. See *supra* note 93 and accompanying text.

173. Spellberg et al., *supra* note 5, at 167.

174. *Id.* at 170.

175. *Id.* at 168.

176. *Id.* at 170.

177. *Id.* at 167.

178. "Resistance may develop against a particular mode of action rather than to a specific patented molecule." Outterson, *supra* note 25, at 95. If the bacterium is resistant to the mode of action, and the existing antibiotic and the novel antibiotic have the same mode of action, the bacterium may be resistant to the novel antibiotic.

179. In addition, treating a resistant infection may be more expensive with a novel antibiotic than with an existing antibiotic. If the existing antibiotic is off-patent, it is presumably cheaper than the novel antibiotic. Thus, there would be no savings generated from the use of the novel antibiotic, and treating the resistant infection with the novel antibiotic would be more expensive than using the existing antibiotic because the novel antibiotic would cost more than the existing drug.

neutral in ten years,¹⁸⁰ but bacteria may develop resistance before then.¹⁸¹ Thus, society may not benefit from a wild-card patent extension to the extent that Spellberg predicts.

Spellberg may have also overestimated the financial benefit of a wild-card patent term extension to a pharmaceutical company that develops a novel antibiotic. Spellberg bases his sales prediction of a novel antibiotic on the average “[s]ales of on-patent drugs with activity against *P. aeruginosa*.”¹⁸² However, seven of the eight antibiotics are broad-spectrum antibiotics,¹⁸³ meaning that they work against a number of different bacteria.¹⁸⁴ Broad-spectrum antibiotics are considered financially beneficial for the pharmaceutical company¹⁸⁵ because these antibiotics can be used against infections caused by many different bacteria, and thus, pharmaceutical companies can sell more.¹⁸⁶ Because broad spectrum antibiotics are more profitable than

180. Spellberg estimates that ten years after the antibiotic is approved the costs of the extension (from higher prices of another drug for two years added to the patent term) will equal societal savings from the extension. Spellberg et al., *supra* note 5, at 170.

181. As previously discussed, antibiotic-resistant strains have emerged as soon as nine years after the antibiotic was introduced. *See supra* note 115 and accompanying text. Because clinical testing exposes the antibiotic to bacteria before the drug is approved, resistance may develop sooner than ten years after the antibiotic is approved.

182. Spellberg et al., *supra* note 5, at 171 tbl.3.

183. Of the eight on-patent drugs listed by Spellberg for treating *Pseudomonas aeruginosa* infections, seven have broad-spectrum activity, or extended-spectrum activity. *See* George L. Arnold et al., *Preliminary Study of Ciprofloxacin in Active Crohn's Disease*, 8 INFLAMMATORY BOWEL DISEASES 10, 10 (2002) (classifying ciprofloxacin as a broad-spectrum antibiotic); D.A. Pastel, *Imipenem-Cilastatin Sodium, a Broad-Spectrum Carbapenem Antibiotic Combination*, 5 CLINICAL PHARMACY 719, 719 (1986) (classifying imipenem as a broad-spectrum antibiotic); D. Raveh et al., *Prospective Drug Utilization of Three Broad-Spectrum Antimicrobials: Cefepime, Piperacillin-Tazobactam and Meropenem*, 99 QJM: INT'L J. MED. 397, 397 (2006) (classifying cefepime, piperacillin-tazobactam, and meropenem as broad-spectrum antibiotics); Mitchell J. Schwaber et al., *Treatment with a Broad-Spectrum Cephalosporin Versus Piperacillin-Tazobactam and the Risk for Isolation of Broad-Spectrum Cephalosporin-Resistant Enterobacter Species*, 47 ANTIMICROBIAL AGENTS & CHEMOTHERAPY 1882, 1883 (2003); (classifying ceftazidime as a broad-spectrum cephalosporin); S. Swoboda et al., *Tissue and Serum Concentrations of Levofloxacin 500 mg Administered Intravenously or Orally for Antibiotic Prophylaxis in Biliary Surgery*, 51 J. ANTIMICROBIAL CHEMOTHERAPY 459, 459 (2003) (classifying levofloxacin as a broad-spectrum antibiotic). The sole non-broad spectrum antibiotic, aztreonam, sold much less well than the seven broad-spectrum antibiotics. *See* Ella Westle-Horton & James A. Koestner, *Aztreonam: A Review of the First Monobactam*, 302 AM. J. MED. SCI. 46, 46 (1991) (classifying aztreonam as a narrow-spectrum antibiotic). In 2003, sales of aztreonam totaled \$20 million, compared to average sales of \$500 million for all eight antibiotics; sales of levofloxacin and ciprofloxacin, the highest selling antibiotics, were \$1.6 billion and \$1 billion respectively. Spellberg et al., *supra* note 5, at 171 tbl.3.

184. *See* BAD BUGS, *supra* note 9, at 15.

185. *See* Carl Nathan & Frederick M. Goldberg, *The Profit Problem in Antibiotic R&D*, 4 NATURE REVIEWS DRUG DISCOVERY 887, 888 (2005).

186. *See* BAD BUGS, *supra* note 9, at 15.

other antibiotics, a sales average based on those antibiotics is inflated and misleading.

Additionally, broad-spectrum antibiotics “are more likely to contribute to the development of resistance.”¹⁸⁷ Hypothetically, if a newly developed antibiotic exhibits broad-spectrum activity, a pharmaceutical company may benefit as Spellberg expects. However, bacteria may develop resistance to that broad-spectrum antibiotic more quickly than it would to a narrow-spectrum antibiotic.¹⁸⁸ Society may not benefit as predicted if bacterial resistance increases healthcare costs by rendering antibiotics ineffective.

In another scenario, the hypothetical antibiotic may exhibit narrow-spectrum activity. As previously mentioned, broad-spectrum antibiotics are more likely to contribute to resistance than narrow-spectrum antibiotics. Thus, a narrow-spectrum antibiotic may more effectively treat antibiotic-resistant infections. Accordingly, society might realize its expected savings if the antibiotic can reduce costs as predicted. However, the pharmaceutical company may not profit as expected because the narrow-spectrum antibiotic would presumably sell poorly¹⁸⁹ in comparison to a broad-spectrum antibiotic. Thus, pharmaceutical companies would be less likely to develop and commercialize a narrow-spectrum antibiotic.¹⁹⁰

Moreover, Spellberg calculated the societal costs of a patent term extension by analyzing the costs associated with the sales of a new antibiotic and the sales of a patented blockbuster drug that accrued over a two-year period.¹⁹¹ This analysis ignores that the wild-card patent term extension may be less than two years, and if so,¹⁹² societal costs resulting from the extension of the patent term for a blockbuster

187. *Id.*; see also Kades, *supra* note 138, at 618 (“[D]octors often prescribe ‘wide-spectrum’ antibiotics—those that are active against many types of bacteria—when a narrower-spectrum drug would suffice. This, of course, accelerates the spread of resistance to those antibiotics that are useful in the greatest variety of cases, in effect wasting the effectiveness of a more valuable drug.”).

188. See BAD BUGS, *supra* note 9, at 15.

189. See Nathan & Goldberg, *supra* note 185, at 888.

190. Proponents of wild-card patent term extensions think that pharmaceutical companies would be motivated to develop an antibiotic regardless of the profit potential for the antibiotic in order to obtain a patent term extension for a blockbuster drug. See LAXMINARAYAN & MALANI, *supra* note 104, at 147 (assuming that a wild-card proposal would give pharmaceutical companies an incentive to develop antibiotics that would be equal to the value of the wild-card patent term extension, implying that the profit potential of the antibiotic would be insignificant). If this is the case, then the inability to profit from the antibiotic does not significantly encourage antibiotic development.

191. Spellberg et al., *supra* note 5, at 169 tbl.1.

192. Under the proposed Project BioShield Act, the patent term extension would last between six months and two years. S. 975, 109th Cong. § 301(b)(4)(A)(iv) (2005).

drug would be less than predicted.¹⁹³ For example, the expensive price of the blockbuster drug while protected by the patent may inhibit its mainstream use¹⁹⁴ by patients who are unable to afford the drug.

On the other hand, it is possible that society could reap a greater benefit than Spellberg predicts.¹⁹⁵ For example, if the antibiotic is effective against a number of antibiotic-resistant bacteria,¹⁹⁶ society could save additional healthcare costs from antibiotic-resistant infections caused by other bacteria.¹⁹⁷ Additionally, Spellberg did not take into account indirect costs associated with drug resistant infection, such as lost productivity¹⁹⁸ or long-term disability.¹⁹⁹ Society could receive a greater benefit than Spellberg estimated if these indirect costs were taken into account.²⁰⁰ However, it is ultimately unclear whether society would enjoy a net benefit even if the costs of the wild-card patent term extension exceed Spellberg's predictions.

b. Suggested Modifications of Wild-Card Proposals

Advocates of a wild-card patent term extension have suggested a number of modifications in response to criticism.²⁰¹ The Infectious Diseases Society of America (IDSA) has suggested (1) limiting the types of drugs eligible for the wild-card patent term extension,²⁰² (2) limiting the length of a patent term extension program,²⁰³ (3) requiring a beneficiary pharmaceutical company to invest part of its profits earned during the extension into antibiotic research and develop-

193. Cf. Spellberg et al., *supra* note 5, at 169 tbl.1 (taking into account only a "base-case estimate for two years of sales based on mean annual sales of top ten selling drugs in the US").

194. See Outterson, *supra* note 25, at 99.

195. Cf. Spellberg et al., *supra* note 5, at 172 ("Given the conservative estimates in our base-case model, the time to cost-neutrality of a single application of wild-card patent term extension might occur years earlier than our estimates.").

196. *Id.* ("It is highly likely that a newly developed antibiotic capable of treating drug-resistant *P. aeruginosa* would also possess activity against other related drug-resistant organisms.").

197. *Id.* ("Hence, reduction in the cost due to these other organisms would dramatically improve the overall cost savings from implementation of the wild-card patent extension.").

198. Cf. *id.* at 172 ("[W]e did not attempt to place a money value on . . . lost wages and family support from death, which would have increased the savings resulting from having a new antibiotic to treat multi-drug-resistant infections.").

199. Cf. *id.*

200. Cf. *id.* (listing factors that "would have increased the savings resulting from having a new antibiotic to treat multi-drug-resistant infections").

201. Letter from Infectious Diseases Soc'y of Am. to Senator Richard Burr, Chairman, Subcomm. on Bioterrorism and Pub. Health, Senate Comm. on Health, Education, Labor & Pensions (Oct. 4, 2005), available at <http://www.idsociety.org/WorkArea/showcontent.aspx?id=3320> (last visited Jan. 12, 2009) [hereinafter Letter].

202. *Id.*

203. *Id.*

ment,²⁰⁴ and (4) establishing an independent commission to identify only certain pathogens that threaten public health as eligible for the wild-card patent term extension.²⁰⁵ Adopting these modifications may appease the opponents of wild-card patent term extensions. However, the resulting decrease in incentives would make any such wild-card program unlikely to significantly spur antibiotic development.

i. Limiting the types of eligible drugs

The IDSA proposes limiting the types of drugs eligible for the patent term extension,²⁰⁶ such as limiting the extension to “lifestyle drugs.”²⁰⁷ This would ameliorate the concern that a longer patent term would endanger the lives of those who may not be able to afford potentially life-saving medications.²⁰⁸ This modification would also appease those who are concerned about the additional costs posed by increasing the patent term of a blockbuster drug.²⁰⁹ However, the potential of encouraging antibiotic development while limiting a wild-card extension to lifestyle drugs is unclear. The market for lifestyle drugs is predicted to continue growing.²¹⁰ Those predictions include anti-depressants and weight-loss drugs.²¹¹ While these drugs may be used as lifestyle drugs, they also treat serious medical problems.²¹² If a wild-card extension is limited to lifestyle drugs that don’t treat a medical disease, then it may not offer a sufficient incentive for antibi-

204. *Id.*

205. See *BAD BUGS*, *supra* note 9, at 23.

206. Letter, *supra* note 201.

207. The Infectious Diseases Society of America does not define what it considers to be a lifestyle drug. See *BAD BUGS*, *supra* note 9, at 16. A lifestyle drug can be defined as a “medicine[] that treat[s] conditions associated with lifestyle such as weight-loss tablets, anti-smoking agents, impotence therapies and hair restorers.” Tim Atkinson, *Lifestyle Drug Market Booming*, 8 *NATURE MED.* 909, 909 (2002). Lifestyle drugs have alternatively been defined as drugs “taken in an attempt to increase personal well-being and quality of life” but not taken “to manage a medically identifiable, well-defined disease.” W. Harth et al., *Lifestyle Drugs in Old Age—A Mini-Review*, 55 *GERONTOLOGY* 13, 13 (2009).

208. See Light, *supra* note 88.

209. *Id.*

210. Joel Lexchin, *Bigger and Better: How Pfizer Redefined Erectile Dysfunction*, 3 *PLoS MED.* 429, 431 (2006), available at <http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=1434483&blobtype=pdf> (“Drug companies have identified lifestyle drugs as a ‘growth market.’”); see also Atkinson, *supra* note 207, at 909 (“[T]he current market lifestyle [sic] for drugs is forecast to rise to over \$29 billion by 2007 from its current \$20 billion.”).

211. *Id.*

212. Harth et al., *supra* note 207, at 14 (“Overweight [sic] represents a major medical problem in our society. Orlistat and sibutramine are used to treat obese patients, but are used as lifestyle drugs in subjects with normal body weight.”); *id.* at 14–15 (“Psychopharmaceuticals . . . are also taken as lifestyle drugs.”).

otic development. If instead a wild-card extension could be applied to drugs that treat a medical disease and have a lifestyle purpose, patients with a clinical need for such drugs may lack financial access to them. Thus, limiting the drugs that are eligible for the extension may significantly reduce the incentive for pharmaceutical companies to develop antibiotics, and it may endanger patients who are unable to afford potentially life-saving drugs protected by an extended patent.

ii. Limiting the duration of a program

The IDSA also suggests that Congress should limit the duration of a wild-card patent term extension program to ten years.²¹³ The IDSA thinks this modification would allow Congress to reevaluate the program's effectiveness and encourage pharmaceutical companies to quickly begin antibiotic development.²¹⁴ However, it is unlikely that the effectiveness of this program could be successfully evaluated after ten years. It takes an average of ten years for an antibiotic to reach the market after its conception.²¹⁵ Thus, after ten years, the first antibiotics, if any, would just be reaching the market,²¹⁶ and the benefits of the antibiotics would remain unclear. In addition, the drug to which the wild-card extension is applied may still be protected by its original patent term. Consequently, the costs associated with the two-year patent term extension would remain unknown. Therefore, a time frame longer than ten years is necessary in order to accurately evaluate the benefits and costs of a wild-card patent term extension.

iii. Requiring investment of patent extension profits

The IDSA suggests that Congress should require a pharmaceutical company to invest some of its profits from the extended patent term into antibiotic or countermeasure research and development.²¹⁷ This suggestion addresses the concern that a wild-card program would give pharmaceutical companies a windfall.²¹⁸ However, this modification

213. See Letter, *supra* note 201.

214. *Id.*

215. See BAD BUGS, *supra* note 9, at 22.

216. An antibiotic developed under this program would need to be conceived of almost immediately after the program is implemented in order to be on the market in ten years. It is unlikely that antibiotic development would be this efficient. Also, any antibiotic that reaches the market within ten years would probably be in development before the program is implemented. In this case, the pharmaceutical company would not be influenced by financial incentive, and thus a wild-card patent term extension would be a windfall. Furthermore, the program could not be effectively evaluated based on development that occurred independently of the program.

217. See Letter, *supra* note 201.

218. See BAD BUGS, *supra* note 9, at 24.

would reduce the incentive for pharmaceutical companies to develop antibiotics because it reduces the pharmaceutical companies' profits.

iv. Predetermining pathogens eligible for the wild-card patent term extension

The IDSA suggests that Congress should establish a commission to evaluate the health threats posed by different infectious diseases.²¹⁹ Those pathogens that the Commission identifies as serious health threats would be eligible for incentives, such as the wild-card extension.²²⁰ This proposal would alleviate the concern that pharmaceutical companies would receive a patent term extension for minor improvements or inconsequential developments. However, it may not encourage pharmaceutical companies to develop antibiotics if it is too difficult to develop a drug for those infectious diseases that are eligible for the program.

c. Additional Problems with the Project BioShield II Act of 2005

The language of the Project BioShield II Act of 2005²²¹ conflicts with the intentions of the Act's sponsor. A pharmaceutical company that develops an approved countermeasure can elect an "eligible patent"²²² to receive the patent term extension. Currently, the Act requires the eligible patent to be owned or licensed by the pharmaceutical company at the time when the pharmaceutical company entered into a contract to develop the countermeasure.²²³ Thus, a pharmaceutical company that develops countermeasures could purchase or license a blockbuster drug from another pharmaceutical company prior to entering into the contract and subsequently the company could obtain up to a two-year patent term extension for that blockbuster drug. However, Senator Lieberman, who introduced the bill, stated that a pharmaceutical company "is eligible to extend the term of any patent owned by the company for two years. *The patent may not be one that is acquired by the company from a third party.*"²²⁴

219. *Id.* at 23.

220. *Id.*

221. *See supra* note 98 and accompanying text.

222. An "eligible patent" is defined as "a patent that at the time the eligible entity entered into the contract, was owned by or licensed to that eligible entity." S. 975, 109th Cong. § 158(a)(3) (2005).

223. When applying for the patent term extension, the pharmaceutical company must include "information indicating that the entity owned or licensed the eligible patent at the time it entered into the contract to develop the countermeasure product." § 158(c)(2)(F).

224. *Creating a BioDefense Industry: Hearing on S. 975 Before the S. Comms. on the Judiciary and on Health, Educ., Labor & Pensions*, 109th Cong. 20 (2004) (statement of Senator Joseph Lieberman) (emphasis added); *see also Preparing a National Biodefense: Hearing on S. 975*

Thus, Lieberman's intent was to prevent such a scenario from occurring, but that intent was not reflected in the Act's language.²²⁵ While the language could easily be amended to remedy this problem, the current language would allow a pharmaceutical company to apply the patent term extension to a licensed blockbuster drug that it did not develop.

3. Patent Prizes

In 2007, Senator Bernie Sanders of Vermont proposed legislation to award a cash reward to developers of a novel drug in lieu of the traditional monopoly patent right;²²⁶ this legislation is characterized as a patent prize system.²²⁷ Patent prizes separate the financial reward for a successful drug from the market of the drug itself.²²⁸ The proposed legislation would put 0.6% of the U.S. GDP—\$80 billion in 2007—into a medical innovation fund.²²⁹ Drug developers would receive a discretionary portion of the fund for a medical innovation.²³⁰ The drug would then enter the public domain so that it could be manufactured and sold by other companies at a marginal cost, which would decrease cost barriers to novel drugs.²³¹ Therefore, the drug developers would derive profit from the government prize, rather than market sales.

Presumably, patent prizes would also lessen the marketing tactics employed by pharmaceutical companies. Currently, pharmaceuticals

Before the Subcomm. on Bioterrorism and Public Health Preparedness of the Comm. on Health, Educ., Labor & Pensions, 109th Cong. 4 (2005) (statement of Senator Joseph Lieberman) (designating the patent term extension available under the Act "for existing patents in a company's portfolio").

225. Cf. LAXMINARAYAN & MALANI, *supra* note 104, at 148 ("At first they obtained a bar on the sale of the wildcard extension (actually a bar to the acquisition of a company with a wildcard extension).").

226. Press Release, Knowledge Ecology Int'l, Experts Comment on Senate Bill That Replaces Monopolies for Medicines with Systems of Prizes (Oct. 19, 2007), available at <http://keionline.org/content/view/150/1> (last visited Sept. 24, 2009).

227. *Id.*

228. *Id.*

229. Medical Innovation Prize Act of 2007, S. 2210, 110th Cong. § 2(18) (2007).

230. The amount of the prize is at the discretion of an appointed board that is responsible for determining the amount of the prize, but the prize for any one invention cannot exceed five percent of the total fund allocation for that year. *Id.* § 9(d)(4). At a minimum, four percent of the fund must be used for "global neglected diseases," ten percent must be used for "orphan drugs," and four percent must be used for "global infectious diseases and other global public health priorities, including research on AIDS, AIDS vaccines, and medicines for responding to bioterrorism." *Id.* § 10(b)(1)–(3).

231. Knowledge Ecology Int'l, *supra* note 226 ("By separating the markets for innovation from the markets for physical goods, the Prize Fund would ensure that everyone, everywhere, could have access to new medicines at marginal costs.").

companies' profits are dependent upon the sales of their drugs. Consequently, pharmaceutical companies aggressively market their drugs to doctors.²³² Some commentators have suggested that "ending patent-based marketing monopolies would transform pharmaceutical marketing practices and likely eliminate most abuses."²³³ These abuses include encouraging the off-label and untested use of prescription drugs, which can have serious, if not fatal, consequences.²³⁴

Those in favor of patent prizes predict that the system would encourage antibiotic development without rewarding excessive antibiotic use.²³⁵ Because the drug developer's profit would not be related to product sales, the developer would presumably have no incentive to market the drug or encourage its overuse. Antibiotics would only be used when needed, and antibiotic choice would be unaffected by price. Ultimately, however, a patent prize system "would be undesirable for antibiotics."²³⁶ Under a patent prize regime, all antibiotics would presumably cost about the same price: the price of manufacture. The low price for antibiotics would likely facilitate overuse.²³⁷ In addition, if all antibiotics are similarly priced, doctors may prescribe newer antibiotics that may be safer or easier for the patient to tolerate in lieu of older but still effective antibiotics that would be more advantageous from a public health perspective. This would unnecessarily increase resistance to newer antibiotics.

One aspect of the Medical Innovation Act of 2007 is that for the new innovation, the prize to be awarded under the Act is independent of any underlying patent.²³⁸ Under this proposal, a patent would not

232. See Rob Weissman, *Pharmaceutical Payola—Drug Marketing to Doctors*, CORPWATCH, May 22, 2008, <http://www.corpwatch.org/article.php?id=15044> (last visited Aug. 16, 2009); see also Daniel Carlat, *Dr. Drug Rep*, N.Y. TIMES MAG., Nov. 25, 2007, at 64 (describing how "taking pharmaceutical money can cloud your judgment").

233. See Weissman, *supra* note 232 (describing money that physicians take from pharmaceutical companies as "bribes").

234. See Mary Ebeling, *Beyond Advertising: The Pharmaceutical Industry's Hidden Marketing Tactics*, <http://www.prwatch.org/node/7026> (last visited Sept. 29, 2009) (describing television advertisements and articles that encourage the off-label use of injectable fillers and their potential side effects, including death due to such off-label use).

235. See Outterson, *supra* note 25, at 91.

236. Kades, *supra* note 138, at 646.

237. *Id.* at 646–47 (arguing that a patent prize system would foster antibiotic resistance "because of the central problem . . . [that] marginal cost pricing of antibiotics leads to excessive use").

238. The bill states the following:

To be eligible to receive a prize payment under subsection (a) for medical innovation relating to a drug, a biological product, or a new manufacturing process a person shall be—

(1) in the case of a drug or biological product, the first person to receive market clearance with respect to the drug or biological product; or

be necessary to receive a prize payment.²³⁹ So long as a drug developer was the first to receive market clearance, that developer could receive a drug prize.²⁴⁰ Because a valid patent would no longer be necessary, developers could move their potential drugs through regulatory hurdles at whatever pace they choose, without the ticking clock of an expiring patent to speed the drug to market. This may be disadvantageous if drug developers delay in bringing new drugs to market, to the detriment of patients who could be treated with that new drug.

It would be far worse if such a system effectively discouraged drug developers from filing for patents. Under the current system, a patent applicant typically files a patent application early in the research and development process.²⁴¹ This is done as early as possible in order to reduce the chance that another party will file or publish prior art that could invalidate the patent application.²⁴² Eighteen months later, that application is published, and it provides information to the world about the invention.²⁴³ Other drug developers and researchers can then use the information that was disclosed in the patent application to make further discoveries or to delve into additional lines of research. This is the quid pro quo upon which the patent system is built.²⁴⁴ However, under the proposed prize system, there is no incentive to disclose an innovation because the rewards from the innovation (the prize) are no longer dependent on disclosing that innovation (via a patent application). Drug developers would thus likely keep their innovations secret, unless and until disclosure is necessary for market clearance. If the innovation does not perform as anticipated in early testing, later clinical testing would likely never begin, and the innovation would never be disclosed. The innovation may be lost to science forever, and an innovation that could pave the way to further life-saving drugs may never be accessible to others. Thus, a proposal that awards a prize for market clearance would discourage the disclosure of innovations.

(2) in the case of a manufacturing process, the holder of the patent with respect to such process.

Medical Innovation Prize Act of 2007, S. 2210, 110th Cong. § 9(b) (2007).

239. *Id.*

240. *Id.*

241. BAD BUGS, *supra* note 9, at 19 (“Most patents are filed during the pre-clinical phase.”).

242. Mengfei Huang & Dennis Fernandez, Deadline Strategies for US Patent Applications, <http://www.iploft.com/deadlines%20article%203.pdf> (last visited Sept. 29, 2009) (“Establishing an early priority or filing date has strategic value by preventing the development of prior art against the applicant’s case from later publication or other disclosures.”).

243. *See supra* note 114 and accompanying text.

244. *See supra* note 112 and accompanying text.

C. *The Best Methods to Combat Antibiotic Resistance Are Inconsistent with Patent Law*

The best way to both slow the spread of antibiotic resistance and effectively use existing antibiotics involves (1) closely regulating antibiotic use,²⁴⁵ and (2) cycling the use of different antibiotics over time.²⁴⁶ However, this would interfere with the rights of the antibiotic patentee.²⁴⁷ If this method was used to combat antibiotic resistance, it would undermine the goal of effectively treating bacterial infection by failing to reward antibiotic innovation, and thus hampering future antibiotic development.

1. *Closely Regulating Antibiotic Use*

The optimal way to stall the spread of antibiotic resistance and effectively use existing antibiotics involves closely regulating antibiotic use.²⁴⁸ Antibiotic use could be closely regulated by a governmental entity.²⁴⁹ Theoretically, the FDA could require pharmaceutical companies to limit the sale of certain antibiotics to prevent antibiotic overuse or institute more stringent requirements to obtain an antibiotic prescription.²⁵⁰ However, commentators doubt the efficacy and sufficiency of such governmental regulations.²⁵¹ Even if such regulations would be effective, closely regulating antibiotic use or cycling the use of antibiotics would decrease the financial incentive for pharmaceuticals to develop antibiotics.²⁵² Closely regulating the use of antibiotics would cause fewer antibiotics to be sold,²⁵³ thereby reducing pharmaceutical companies' profits. As previously discussed, fewer antibiotics are currently being developed because they have a smaller profit potential than other types of drugs.²⁵⁴ If pharmaceutical companies' profits are decreased because of antibiotic use regula-

245. See Dryden, *supra* note 26, at 887 (“[T]he only way is to have more, not less, regulation of the use of antibiotics.”).

246. Outterson, *supra* note 25, at 100.

247. See *infra* notes 248–260 and accompanying text.

248. See Dryden, *supra* note 26, at 887.

249. See Kades, *supra* note 138, at 637 (“Regulating antibiotics entails a strict limit on the number of doses administered, or strict guidelines on use.”).

250. See *id.* at 636 (listing the measures suggested by the Center for Science in the Public Interest as including “requir[ing] tests to identify infectious agents before prescribing antibiotics.”).

251. See *id.* at 637–38 (“Given doctors’ and patients’ incentives, and the ease of lying about the variety of infections being treated, monitoring prescriptions might prove insufficient.”).

252. Cf. BAD BUGS, *supra* note 9, at 17 (“[P]hysicians’ efforts to preserve antibiotics for the treatment of resistant infections serve as a disincentive to antibiotic discovery and development.”).

253. *Id.*

254. *Id.* at 15.

tion, pharmaceutical companies would be even less likely to develop novel antibiotics.

2. *Cycling Antibiotic Use*

Cycling the use of antibiotics is another strategy to counter antibiotic resistance.²⁵⁵ Cycling involves using a certain antibiotic until bacteria become resistant to it, and then switching to a different antibiotic or class of antibiotics.²⁵⁶ Advocates hope that this would allow existing antibiotics to be used in an effective manner that minimizes resistance.²⁵⁷ Under a cycling regime, the government would only permit the production and sales of the chosen antibiotic until bacteria became resistant, at which point a new antibiotic would be selected.²⁵⁸ A pharmaceutical company that developed a successful, novel antibiotic could not sell it until the current antibiotic became ineffective.²⁵⁹ At that point, the antibiotic may or may not still have patent protection.²⁶⁰ If the pharmaceutical company is prohibited from selling the antibiotic while it is patent protected, the novel antibiotic patent owner essentially loses its patent term.

3. *Close Regulation of Antibiotic Use or Cycling Antibiotics*

While the goal of closely regulating and cycling antibiotic use is to better conserve existing antibiotics, antibiotic conservation is insufficient in itself to counter the problems posed by bacterial infections.²⁶¹ Regardless of how carefully antibiotic use is regulated or how successful the cycling program is, bacteria will still likely develop resistance to the current supply of antibiotics.²⁶² Thus, new antibiotic development will still be necessary in order to combat bacterial infections.²⁶³ Additionally, closely regulating antibiotic use and cycling antibiotics would discourage the development of novel antibiotics.²⁶⁴ Because antibiotic development is necessary to combat antibiotic resistance, conserv-

255. See Kades, *supra* note 138, at 620.

256. *Id.*

257. See Outterson, *supra* note 25, at 100.

258. See Kades, *supra* note 138, at 620.

259. *Id.*

260. If the newly developed antibiotic is not chosen for use before the patent expires, then that antibiotic could only be sold once it enters the public domain (i.e., after the patent expires).

261. See Outterson, *supra* note 25, at 69.

262. *Id.*

263. *Id.*

264. Cf. BAD BUGS, *supra* note 9, at 17 (“[P]hysicians’ efforts to preserve antibiotics for the treatment of resistant infections serve as a disincentive to antibiotic discovery and development.”).

ing antibiotics could actually undermine the goal of decreasing antibiotic resistance.

V. IMPACT

Many of the solutions proposed to combat antibiotic resistance would use patent-based incentives to encourage pharmaceutical companies to develop novel antibiotics. However, as previously discussed, these patent-based proposals would likely be ineffective. Commentators suggest alternative proposals to stimulate antibiotic development, including providing government research subsidies and providing tax breaks.²⁶⁵ Similar to a patent prize proposal, these proposals aim to “curb antibiotic use and at the same time spur innovation.”²⁶⁶ These proposals also pose problems. For a subsidy program, the antibiotic-developing pharmaceutical company would be chosen before the antibiotic is developed.²⁶⁷ If a successful antibiotic is not developed, then the government, tax-payers and those who would potentially benefit from the antibiotic, would bear that burden.²⁶⁸ Even if an award in the form of tax credits was used instead, it would only be effective at spurring antibiotic development if the financial reward provided the pharmaceutical company with a profit that made antibiotic development financially beneficial.

These problem would be best addressed by direct governmental action, and not by indirectly encouraging private actors—such as pharmaceutical companies—to change their behavior. Instead of merely funding research and development at an early stage, the government could also perform later-stage development and clinical testing, so that it can develop antibiotics itself. Additionally, society could benefit because the government could closely regulate the antibiotic or cycle its use as appropriate. By closely regulating and cycling the antibiotics that it develops itself, the government can preserve the usefulness of the antibiotic without facing political pressure from a pharmaceutical company that hopes to profit from the antibiotic or discouraging future antibiotic development. Thus, antibiotic development would not depend on ensuring that pharmaceutical companies profit from antibiotic development.

265. LAXMINARAYAN & MALANI, *supra* note 104, at 148.

266. *Id.*

267. *Id.*

268. *Id.* at 149.

V. CONCLUSION

Antibiotic resistance is a serious threat to public health. Countering this threat requires the conservation of existing antibiotics and the development of new antibiotics. However, the patent system does not encourage conservation, and it does not spur the development of new antibiotics. The proposals seeking to extend the patent term would not function as anticipated by their proponents. The anticipated benefit—increased antibiotic development—is likely overestimated. Patent law should not be used to spur antibiotic development. Instead, the government should directly develop antibiotics itself.

*Jessica P. Schulman**

* J. D. Candidate 2010, DePaul University College of Law; B.S. (2007) B.A. (2007), University of Rochester.

