ANOTHER HOLY TRINITY: PHARMACEUTICALS, AGRICULTURE, AND HEALTH. THE SHORTCOMINGS OF THE FDA AND THE PATH TO ENLIGHTENMENT

Michael C. Bootz†

I. INTRODUCTION

As the population of the world explodes, natural resources dwindle. To provide for the expected nine billion world population by 2050,[1] basic necessities such as food and water must be advanced by technology—otherwise great suffering will occur.[2] However, the technological advancement needed in agriculture is currently

† Michael C. Bootz is a recent graduate from Drake University Law School, where he received certificates in Intellectual Property Law and Health Law.

1. Melody Finnemore, *Laura Schroeder's Expertise Addresses Water Use in the U.S. and Abroad*, OR. ST. B. BULL. (Jan. 2012), https://www.osbar.org/publications/bulletin/12jan/profiles.html.

2. *Id.* ("[T]he United Nations estimates that at our current usage rates, almost 3 billion

being thwarted by the Food and Drug Administration (FDA).[3] The over-regulation[4] and under-regulation[5] conflicts of the FDA must be addressed to prevent the dooming deterioration of the standard of living. Privatization of the FDA with reasonable oversight policies must be established to continue advancement of innovation while protecting health.[6]

II. OVERVIEW OF PHARMACEUTICAL DRUGS

In a cell, substrates naturally bind to receptors causing a change of cellular activity.[7] Pharmaceutical drugs closely resemble this process and allow for the alteration of cellular activity for desired results.[8] This may range from increasing or decreasing the electrochemical gradient of a cell membrane[9] to cause cytolysis, the bursting of the cell membrane.[10]

A. Pharmaceutical Drugs: Definition, Importance, Interactions, and the Effect on Humans and Agriculture

Pharmaceutical drugs help to treat various types of diseases, improve the quality of life of people, and aid in the prevention of diseases.[11] Thus, pharmaceutical drugs are of vital importance to human and animal health. "The term drug means . . . [a]rticles intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or other animals; . . . articles (other than food)

people will face severe water shortages by 2025.").

3. *See* SCI. LOOKING FORWARD SUBCOMM., FDA, MISSION IMPOSSIBLE: HOW FDA CAN MOVE AT THE SPEED OF SCIENCE 4 (2015), http://www.fda.gov/downloads/aboutfda/reportsmanualsforms/reports/ucm463328.pdf.

4. *See* WILLIAM H. EAGLSTEIN, THE FDA FOR DOCTORS 85 (2014).

5. *See* Brief for New England Journal of Medicine as Amici Curiae in Support of Respondent at 7, Wyeth v. Levine, (Aug. 14, 2008) (No. 06-1249), 2008 WL 3851616.

6. *Cf.* Daniel P. Carpenter, *The Political Economy of FDA Drug Review: Processing, Politics, and Lessons for Policy*, HEALTH AFF. 52 (2004), http://content.healthaffairs.org/content/23/1/52.full.pdf (acknowledging the same issues faced by privatization initiatives).

7. *Mechanism of Drug Action - Drug Receptor Interactions*, HOWMED, http://howmed.net/pharmacology/mechanism-of-drug-action-drug-receptor-interactions/ (last visited July 28, 2017).

8. *See Pharma. . .WHAT?*, AM. ASS'N C. PHARMACY, http://www.aacp.org/resources/student/pharmacyforyou/Pages/pharmawhat.aspx (last updated Oct. 26, 2016, 1:06 PM) [hereinafter *Pharma. . .WHAT?*].

9. *See* JOSEPH A. JOYCE, PHARMACOLOGY FOR NURSE ANESTHESIOLOGY 119 (Richard G. Ouellette & Joseph A. Joyce eds., 2010).

10. *See* STEWART SELL, IMMUNOLOGY, IMMUNOPATHOLOGY, AND IMMUNITY 276 (6th ed. 2001).

11. *Importance of Pharmaceuticals in Our Lives*, EHEALTH MED., http://ehealthmedical.com/importance-of-pharmaceuticals-in-our-lives/ (last visited July 28, 2017).

intended to affect the structure or any function of the body of man or other animals; . . ."[12] Drugs are made to interact with cells to achieve a desired result.[13] These cellular interactions are between a ligand or substrate and a binding site. This is described as either lock-and-key or induced-fit hypotheses.[14] For the lock-and-key hypothesis, once the ligand or substrate and binding site are joined, the effect is initiated.[15] In regard to the generally favored induced-fit hypothesis, the exposure of a binding site to a ligand or substrate causes the active binding site to change conformation in order to allow the ligand or substrate to connect with the binding site.[16] Under either model, once the substrate and binding site are bound and activated, various cascade reactions can occur within the cell.[17] These interactions can be influenced by pharmaceutical drugs, causing a desired effect.[18] The desired effect can apply to human health and agriculture in regard to augmenting livestock, as well as optimizing the genetic expression of seeds.[19]

Cellular messaging through the chemical interaction of such a binding can also be influenced to optimize human health.[20] Drugs can "interfere with microorganisms (germs) that invade your body, destroy abnormal cells that cause cancer, replace deficient substances (such as hormones or vitamins), or change the way that cells work in your body."[21]

For example, diabetes "describes a group of metabolic diseases in which the person has high blood glucose (blood sugar), either because insulin production is

12. 21 U.S.C. § 321(g)(1) (2012).

13. *See Pharma. . .What?*, *supra* note 8.

14. *See Difference Between Lock and Key Hypothesis and Induced Fit Hypothesis*, MAJOR DIFFERENCES, http://www.majordifferences.com/2014/04/difference-between-lock-and-key.html#.VlIfHfmrSUl (last visited July 28, 2017).

15. *Lock-and-Key Mechanism*, ENCYLOPEDIA.COM, http://www.encyclopedia.com/doc/1O6-lockandkeymechanism.html (last visited July 28, 2017).

16. *Induced-Fit Model*, ENCYLOPEDIA.COM, http://www.encyclopedia.com/doc/1O6-inducedfitmodel.html (last visited July 28, 2017).

17. *Cell Signaling*, SCITABLE, http://www.nature.com/scitable/topicpage/cell-signaling-14047077 (last visited July 28, 2017).

18. *See Taking Medicines: Side Effects*, NIH SENIOR HEALTH, http://nihseniorhealth.gov/takingmedicines/sideeffects/01.html (last visited June 13, 2017).

19. *Veterinary Product Database*, DRUGS.COM, http://www.drugs.com/vet/ (last visited July 28, 2017) (listing pharmaceutical information for livestock and related desired effects); *see, e.g.*, Bethany Percha et al., *Discovery and Explanation of Drug-Drug Interactions via Text Mining*, *in* PACIFIC SYMPOSIUM ON BIOCOMPUTING 410, 410 (Russ B. Altman et al. eds., 2012) (describing drug-drug and drug-gene-drug interactions).

20. Hong-Fang Ji et al., *Natural Products and Drug Discovery. Can Thousands of Years of Ancient Medical Knowledge Lead Us to New and Powerful Drug Combinations in the Fight Against Cancer and Dementia?*, *in* 10 EMBO REP. 194, 194 (2009).

21. Michael Bihari, *How Do Drugs Work in Your Body?*, VERYWELL, https://www.verywell.com/how-drugs-work-in-your-body-1124115 (last updated July 12, 2017).

inadequate, or because the body's cells do not respond properly to insulin, or both."[22] After a meal, blood sugar levels rise, causing beta cells of the pancreas to release insulin into your bloodstream.[23] "Insulin then attaches to and signals cells to absorb sugar from the bloodstream. [Therefore,] [i]nsulin is often described as a 'key,' which unlocks the cell to allow sugar to enter the cell and be used for energy."[24] Without insulin, the body maintains a high blood sugar which "can lead to complications such as blindness, nerve damage (neuropathy) and kidney damage."[25]

As a treatment, insulin is injected into the body and binds to cells.[26] This allows for the cellular uptake of glucose and avoids complications from hyperglycemia.[27] The diabetes diet is an additional aspect of treatment for diabetes.[28] Diet is pertinent to overall health, since a healthy diet is important:

> [1] to maintain health by preventing loss of muscle strength, bone mass, and vitamin deficiency states; [2] to prevent diseases such as heart attacks, strokes, obesity, osteoporosis, and certain cancers; and [3] to help control and/or treat chronic diseases and conditions such as high blood pressure, diabetes mellitus, sleep apnea, and celiac disease.[29]

Diets have long been recognized as vital. This notion is evidenced by President Abraham Lincoln creating the United States Department of Agriculture (USDA), signing into law an Act to establish the Department in 1862.[30] President Lincoln described the USDA as "The People's Department."[31] Agriculture relates to the cultivation of crops and the rearing of animals.[32] Agriculture can be advanced

22. *Diabetes: Symptoms, Causes and Treatments*, MED. NEWS TODAY, www.medicalnewstoday.com/info/diabetes (last updated Jan. 5, 2016).

23. Amy Hess-Fischl, *What is Insulin?*, ENDOCRINEWEB, https://www.endocrineweb.com/conditions/type-1-diabetes/what-insulin (last updated Apr. 7, 2017).

24. *Id*.

25. *Diabetes Treatment: Using Insulin to Manage Blood Sugar*, MAYO CLINIC (Apr. 29, 2016), http://www.mayoclinic.org/diseases-conditions/diabetes/in-depth/diabetes-treatment/art-20044084.

26. Hess-Fischl, *supra* note 23.

27. *Id*.

28. *See Diabetes Diet: Create Your Healthy-Eating Plan*, MAYO CLINIC (Mar. 25, 2017), http://www.mayoclinic.org/diseases-conditions/diabetes/in-depth/diabetes-diet/art-20044295.

29. Melissa Conrad Stöppler, *Disease Prevention Through Diet & Nutrition*, MEDICINENET.COM, http://www.medicinenet.com/prevention/article.htm (last updated Aug. 23, 2016).

30. *An Act to Establish a Department of Agriculture*, USDA, http://www.nal.usda.gov/act-establish-department-agriculture (last visited July 28, 2017).

31. *USDA Celebrates 150 Years*, USDA, http://www.usda.gov/our-agency/about-usda/history (last visited July 28, 2017).

32. *Farming*, ENCYLOPEDIA.COM, http://www.encyclopedia.com/plants-and-animals/agriculture-and0horticulture/agriculture-general/Farms (last visited July 28, 2017).

to maximize nutrients produced through altering the genetic expression of crops and animals—known as genetically modified organisms (GMOs)—and augmenting crops and livestock via pharmaceutical drugs.[33] GMOs initially proposed a dilemma in regard to jurisdiction.[34]

B. The EPA, USDA, and FDA Regulate Agriculture; the FDA has Jurisdiction over GMOs

One government agency that regulates agriculture is the Environmental Protection Agency (EPA). The EPA protects human health and the environment by writing and enforcing regulations based on laws passed by Congress, and they regulate bio-pesticides through the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which allows the regulation of Bacillus thuringiensis (Bt) toxins.[35] Another government agency that regulates agriculture is the USDA, which administers programs to help American farmers and ensures food safety for consumers.[36] Lastly, the "FDA is responsible for protecting the public health by assuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation."[37] Thus, regulation of agriculture in the United States is divided among three regulatory agencies: the USDA, FDA, and EPA. Each of these agencies regulate agriculture from a different perspective.[38]

Jurisdiction over GMOs was placed under the FDA because GMOs are considered a drug.[39] In 1938, Congress passed the Federal Food, Drug, and Cosmetic Act (FDCA), which is enforced by the FDA to assure "foods are pure and safe to eat, that drugs and medical devices are safe and effective, and that cosmetics are

33. *See* Marc Lallanilla, *GMOs: Facts About Genetically Modified Food*, LIVESCIENCE (Jan. 11, 2016, 10:49 PM), http://www.livescience.com/40895-gmo-facts.html.

34. *See* United States v. Pro-Ag, Inc., 968 F.2d 681, 682 (8th Cir. 1992).

35. *U.S. Regulation of Genetically Modified Crops*, FED'N AM. SCIENTISTS, http://fas.org/biosecurity/education/dualuse-agriculture/2.-agricultural-biotechnology/us-regulation-of-genetically-engineered-crops.html (last visited July 28, 2017) [hereinafter *Genetically Modified Crops*].

36. David Wallechinsky, *Department of Agriculture*, ALLGOV, http://www.allgov.com/departments/department-of-agriculture?detailsDepartmentID=568 (last visited July 28, 2017).

37. *What We Do*, U.S. FOOD & DRUG ADMIN., http://www.fda.gov/aboutFDA/whatwedo/ (last updated Apr. 4, 2017).

38. *Genetically Modified Crops*, *supra* note 35.

39. *Pro-Ag, Inc.*, 968 F.2d at 681-82 (holding that products which were intended to alter structure or function of the body of animals—by improving feed efficiency and increasing milk production—were "drugs," rather than animal biologics. Thus, the FDA had jurisdiction over the products, rather than the USDA—pursuant to the Virus-Serum-Toxin Act).

safe."[40] The FDA regulates agriculture by ensuring food safety through inspection.[41] Furthermore, inspection is aided by the USDA through various agencies such as the Food Safety and Inspection Service (FSIS) and the Animal and Plant Health Inspection Service (APHIS).[42] FSIS is responsible for ensuring the nation's commercial supply of meat, poultry, and egg products are safe from disease and are correctly labeled and packaged to minimize contamination.[43] Conversely, APHIS is responsible for administering the Animal Welfare Act, carrying out wildlife damage management activities, and regulating GMOs.[44]

To ensure compliance, the FDA requires premarketing approval for new prescription drugs.[45] If approved, drugs such as pesticides, antibiotics, and hormones can be used on plants as well as livestock in Australia.[46] The use of pesticides, insecticides, and herbicides in crops boost production and ensure an adequate food supply for the increasing human population.[47] The use of drugs in livestock is fundamental to animal health.[48]

> There are five major classes of drugs used in food animals: (1) topical antiseptics, bactericides, and fungicides used to treat surface skin or hoof infections, cuts, and abrasions; (2) ionophores, which alter rumen microorganisms to provide more favorable and efficient energy substrates from bacterial conversion of feed and to impart some degree of protection against some parasites; (3) steroid anabolic growth promoters (whose mechanism of action resides in the interaction of estrogen-, progesterone-, or testosterone-like compounds with specific classes of hormone receptors in animal cells) and peptide production enhancers (recombinant bovine somatotropin for increased milk production in dairy cows); (4) antiparasite drugs; and (5) antibiotics as used to control overt and occult diseases, and to promote growth.[49]

The challenge of the FDA "is to balance a reliable, high-quality food supply

40. *Overview of Federal Food, Drug, and Cosmetic Act*, NAMBA L. OFF., http://www.nambalaw.com/sacramento_injury_14.html (last visited July 28, 2017).

41. *Inspections Database*, U.S. FOOD & DRUG ADMIN., https://www.fda.gov/iceci/inspections/ucm222557.htm (last updated Apr. 12, 2017).

42. *See* Wallechinsky, *supra* note 36.

43. David Wallechinsky, *Animal and Plant Health Inspection Service*, ALLGOV, http://www.allgov.com/departments/department-of-agriculture?detailsDepartmentID=568 (last visited July 28, 2017).

44. *Id*.

45. EAGLSTEIN, *supra* note 4, at 6.

46. *Food-Pesticides and Other Chemicals*, BETTER HEALTH CHANNEL, https://www.betterhealth.vic.gov.au/health/healthyliving/food-pesticides-and-other-chemicals (last updated Sept. 2014) [hereinafter *Pesticides and Other Chemicals*].

47. *Id*.

48. JAMES R. COFFMAN ET AL., THE USE OF DRUGS IN FOOD ANIMALS: BENEFITS AND RISKS 12 (1999).

49. *Id*. at 12-13.

with the need to protect the consumer from unnecessary exposure to chemicals."[50] The drug approval process of the FDA is criticized as being guilty of both over-regulation[51] and under-regulation.[52]

III. CRITICISMS OF THE FDA

The FDA is criticized for increasing the costs of pharmaceutical research, thereby reducing the supply of new and effective drugs.[53] To remedy the harm created by this, the drug approval process must be privatized in certain aspects in order to solve the issues of over-regulation[54] and under-regulation.[55] In doing so, the cost of research and development will be reduced, and the approval of therapeutic drugs will be accelerated.[56] In time, this will increase the supply of new and effective drugs, ensuring public health.[57]

A. Over-Regulation by the FDA Results in a Biased, Slow, and Costly Process

Congress passed the Kefauver-Harris Amendments, extensive FDA testing and approval procedures, in 1962.[58] These amendments were established "in response to a public outcry resulting from serious birth defects caused by prescription use of thalidomide," a sedative for pregnant females, without adequate safety testing.[59] "These amendments imposed guidelines for the process of drug approval in the [U.S.] and required that a drug be safe as well as effective before it could be approved and marketed."[60] The New Drug Application (NDA) procedure is criti-

50. *Pesticides and Other Chemicals*, *supra* note 46.

51. EAGLSTEIN, *supra* note 4, at 85.

52. *See* Brief for New England Journal of Medicine as Amici Curiae in Support of Respondent, *supra* note 5, at 7.

53. *Quotations: Economists' Judgments About the FDA*, FDAREVIEW.ORG, http://www.fdareview.org/quotations.shtml (last visited July 28, 2017) [hereinafter *Judgments About the FDA*].

54. *See* Carpenter, *supra* note 6, at 52.

55. *See* Brief for New England Journal of Medicine as Amici Curiae in Support of Respondent, *supra* note 5, at 7.

56. *See* Carpenter, *supra* note 6, at 52.

57. *Id*.

58. Robert John Kane & Lawrence E. Singer, *FDA Approval Process—Criticism and the FDA Response*, 22 ILL. PRAC., L. MED. PRAC. ILL. § 39:15 (2015); Chanapa Tantibanchachai, *US Regulatory Response to Thalidomide (1950-2000)*, EMBRYO PROJECT ENCYCLOPEDIA, https://embryo.asu.edu/pages/us-regulatory-response-thalidomide-1950-2000 (last updated Apr. 1, 2014).

59. Kane & Singer, *supra* note 58, at § 39:15; Tantibanchachai, *supra* note 58.

60. Tantibanchachai, *supra* note 58.

cized as being over-regulated, as the FDA's regulatory reach and intensity has increased over the past ten years.[61] The over-regulation has resulted in stifling innovation by being too time consuming, costly, and biased towards not approving new drugs.[62] The approval process is time consuming, and "can be divided into several stages: a research and development phase with preclinical testing (average 1–3 years), a clinical research and development period including phase I, II and III testing (average 5–10 years), and a new drug application FDA review with post-marketing surveillance (average 2 years)."[63] "It is estimated that the average length of time from concept to market for investigational new drugs is about 12 years, which has increased significantly from just under 8 years in the 1960s, with an estimated total cost per drug of $800 million."[64] Since the approval of a new drug is time consuming and costly, pharmaceuticals are limited in the number of drugs they develop each year; thus, the FDA's over-regulation stifles innovation by being cost prohibitive.[65]

The approval process is also an investment for the FDA, as it requires the FDA to take a chance with its reputation.[66] This leads to the conclusion that the application process for an NDA is inherently biased against the pharmaceutical companies with legitimate cures. Bias could be present in the FDA's approval process results due to high uncertainty, asymmetric observability of error, and low reversibility.[67]

"FDA officials know that even the most successful clinical trials cannot eliminate the possibility that a drug will turn out to be unsafe or inefficacious, resulting in inherent uncertainty."[68] Thus, the rejection of a drug behooves the FDA's approval rating in light of this inherent uncertainty[69] because of the asymmetric observability of error.[70] The asymmetric observability of error explains how the regulatory process is inherently biased against approval of legitimate drugs be-

61. *Id*.

62. *See generally* Carpenter, *supra* note 6, at 52.

63. Kyle M. Fargen et al., *The FDA Approval Process for Medical Devices*, MEDSCAPE (2013), http://www.medscape.com/viewarticle/807243_2.

64. *Id*.

65. David Kroll, *The New York Times Misplaces FDA Blame in Latest Dietary Supplement Spiking Episode*, FORBES (Apr. 14, 2015, 10:32 AM), http://www.forbes.com/sites/davidkroll/2015/04/14/the-new-york-times-misplaces-fda-blame-in-latest-dietary-supplement-spiking-episode/.

66. Carpenter, *supra* note 6, at 55.

67. *Id*.

68. *Id*.

69. *See id*.

70. *Id*.

cause the consequences of denying a useful drug are undetectable, while the consequences of mistakenly approving a harmful drug are highly publicized.[71] Therefore, the FDA will take the action that will result in the least public criticism in order to maintain its reputation, regardless of penalties to public health.[72]

Even though approval of a "harmful" drug "[is] procedurally reversible, the FDA views drug approval as irreversible from the standpoint of reputation."[73] Since reversing an approval for a drug would infer incompetence, the FDA's reputation or public approval would be harmed, which has increased from 38% in 2009[74] to 58% in 2014.[75]

For example, Genasense affects the bcl-2 family proteins,[76] which function to regulate apoptosis, the normal cycle of death in a cell.[77] Genasense increases the cancer-killing activity of many standard anti-cancer therapies; thus, it has the potential to work in many different types of cancer.[78] Genta, a smaller pharmaceutical company that developed Genasense, filed an application for the treatment of melanoma that was denied because "of an apparent mathematical error on the part of the FDA in analyzing the data."[79] Genta filed a complaint under the Federal Data Quality Act to correct the record; nonetheless, Genasense was denied.[80] In response, Genta filed a new application of Genasense for the treatment of chronic lymphocytic leukemia (CLL).[81] A study involving patients with advanced CLL reported an increase of a complete or partial response of 7%, and an increase in the durability of the remission by fourteen months.[82] Despite primary and secondary endpoints being achieved in Phase III clinical trials, the FDA rejected Genasense in a seven-

71. *Id*.

72. *Id*.

73. *Id*.

74. Lydia Saad, *CDC Tops Agency Ratings; Federal Reserve Board Lowest*, GALLUP (July 27, 2009), http://www.gallup.com/poll/121886/cdc-tops-agency-ratings-federal-reserve-board-lowest.aspx (indicating 38% of Americans had an "excellent" or "good job").

75. Alexander Gaffney, *Public View of FDA Continues to Improve in New Poll*, REG. AFF. PROFS. SOC'Y (Oct. 02, 2014), http://www.raps.org/Regulatory-Focus/News/2014/10/02/20463/Public-View-of-FDA-Continues-to-Improve-in-New-Poll/ ("Fifty-eight percent of consumers had either a favorable or somewhat favorable view of the FDA in the poll—far better than the 32% favorability rating of the federal government.").

76. William Faloon & Donna Pogliano, *Life-Saving Cancer Drugs Not Approved by the FDA*, LIFE EXTENSION MAG. (Sept. 2007), http://www.lifeextension.com/magazine/2007/9/cover_lscancer/page-02.

77. K.W. Yip & J.C. Reed, *Bcl-2 Family Proteins and Cancer*, *in* 27 ONCOGENE 6398, 6398 (2008).

78. Faloon & Pogliano, *supra* note 76.

79. *Id*.

80. *Id*.

81. *Id*.

82. *Id*.

to-three vote for the treatment of CLL for being a "theoretical construct."[83] The FDA suggested that Genta give the drug away under their expanded access program; however, Genta could not afford to give Genasense away.[84] The FDA's decision on Genasense seems to be an injustice to the cancer patients who are waiting for the marketing of this promising drug.[85] "When effective new drugs are delayed or denied [because of over-regulation], the inevitable consequence is needless human suffering and death."[86]

B. Under-Regulation of the FDA Induces Lobbyists and Negatively Impacts Human Health

In a $1.8 million report[87] released September 22, 2006, the Institute of Medicine (IOM) committee found:

> [t]he drug safety system is impaired by the following factors: serious resource constraints that weaken the quality and quantity of the science that is brought to bear on drug safety; an organizational culture in CDER that is not optimally functional; and unclear and insufficient regulatory authorities particularly with respect to enforcement.[88]

After these findings, the IOM suggested twenty-five sweeping changes to bolster drug safety.[89] In response, "[o]n June 30, 2008, the [FDA] shifted authority on drug safety regulatory issues from the Office of New Drugs (OND) to a shared responsibility between OND and the Office of Surveillance and Epidemiology (OSE)."[90] However, the under-regulation of the FDA's approval process persists and results in "high political stakes that induce lobbying by interested parties,"[91] fails to ensure safety in drug storage and labeling, and allows the use of dangerous agricultural chemicals, food additives, and food processing techniques.[92]

---

83. *Id*.

84. *Id*.

85. *See id*.

86. *Id*.

87. Diedtra Henderson, *Panel: FDA Needs More Power, Funds*, BOS. GLOBE (Sept. 23, 2006), http://www.highbeam.com/doc/1P2-7979200.html.

88. SHEILA BURKE ET AL., THE FUTURE OF DRUG SAFETY: PROMOTING AND PROTECTING THE HEALTH OF THE PUBLIC 4 (2006).

89. Henderson, *supra* note 87.

90. *FDA Acts on Drug Safety Recommendation in IOM Report*, NAT'L ACADEMIES SCI., ENGINEERING MED., https://iom.nationalacademies.org/Reports/2006/The-Future-of-Drug-Safety-Promoting-and-Protecting-the-Health-of-the-Public/Change-Drug-Safety-Policy-FDA.aspx (last updated July 24, 2013).

91. Carpenter, *supra* note 6, at 52.

92. Press Release, Ctr. for Food Safety, Center for Food Safety Sues FDA Over Food Additives (Feb. 21, 2014) (on file with author).

For example, Monsanto, Inc. sells a genetically engineered hormone, Recombinant Bovine Growth Hormone (rBGH), to increase milk production in cows.[93] Milk produced from rBGH-treated cows contains higher levels of Insulin Growth Factor-1 (IGF-1).[94] While humans naturally have IGF-1, elevated levels of IGF-1 in humans have been linked to prostate, colon, and breast cancer.[95] Despite increasing evidence that rBGH affects the immune system and increases the risk of prostate, colon, and breast cancer, rBGH remains FDA approved while the European Commission banned the use of rBGH in 2000.[96] The disregard of scientific evidence in forbidding the sale of rBGH represents the under-regulation of the FDA, allowing lobbyists to influence the approval process.

Associate Director of the FDA's Office of Drug Safety, Dr. David J. Graham, stated the "FDA is inherently biased in favor of the pharmaceutical industry. It views industry as its client, whose interest it must represent and advance."[97] Dr. Graham's claims are not without merit.[98] Since the passing of the Prescription Drug User Fee Act (PDUFA), pharmaceuticals were enabled to directly fund FDA review; thus, "the FDA started looking upon the industry as their client, instead of the public and the public health, which should be the client."[99] The increasing complaints and allegations of undue pharmaceutical industry influence led to the House Energy and Commerce Committee's Subcommittee on Oversight and Investigations inquiry into FDA's practices, which is currently ongoing.[100]

For instance, AquaBounty Technologies, owned by Intrexon, developed a genetically modified salmon, which is known as "Frankenfish."[101] This Frankenfish "was conceived by combining genes from Chinook salmon that produce extra growth hormone with an antifreeze gene from a bottom-feeder, the non-kosher ocean pout. The result is a fish that grows far faster and larger than non-engineered

93. JOHN C. HARRINGTON, THE CHALLENGE TO POWER: MONEY, INVESTING, AND DEMOCRACY 25-26 (Safir Ahmed ed., 2005).

94. *rBGH*, GRACE COMM. FOUND., http://www.sustainabletable.org/797/rbgh (last visited July 28, 2017) [hereinafter *rBGH*].

95. William J. Cromie, *Growth Factor Raises Cancer Risk*, HARV. GAZETTE (Apr. 22, 1999), http://news.harvard.edu/gazette/1999/04.22/igf1.story.html.

96. *rBGH*, *supra* note 94; *see* HARRINGTON, *supra* note 93, at 25-26.

97. Dick Carozza, *An Interview with Dr. David J. Garham, Associate Director of the FDA's Office of Drug Safety*, FRAUD MAG., Sept.–Oct. 2005, at 36, 39.

98. *Id*.

99. Sidney Wolfe, *How Independent is the FDA?*, FRONTLINE (Nov. 13, 2003), http://www.pbs.org/wgbh/pages/frontline/shows/prescription/hazard/independent.html.

100. *See* Sarah N. Lynch, *House Committee Launches Review of FDA Criminal Office*, REUTERS (Sept. 21, 2016, 7:05 AM), http://www.reuters.com/article/us-usa-fda-congress-idUSKCN11R1E4.

101. Tom Colicchio, Opinion, *Are You Eating Frankenfish?*, N.Y. TIMES (Dec. 15, 2015), http://www.nytimes.com/2015/12/15/opinion/are-you-eating-frankenfish.html.

salmon."[102] In December of 2015, "the FDA did its best to sneak [Frankenfish] by consumers when it quietly announced it was launching a 60-day public comment period."[103] "The FDA claims 'Frankenfish' won't harm the environment, endanger human health, or harm natural populations of salmon."[104] The narrative put forth "conflicts with the FDA's own data—derived from AquaBounty's internal research—which shows [Frankenfish] increases the potential for allergies."[105] In response to the FDA, more than forty "Congress members have urged the FDA to conduct a more rigorous review of environmental and health safety concerns" of Frankenfish before approving it, which the FDA has failed to do.[106] If approved, Frankenfish could open the door for other transgenic meats; thus, Frankenfish is the biotech industry's next "million dollar baby."[107] Although technology must be used in agriculture to address the needs of the world's growing population, advances must ensure public health through sound scientific research and not the lobbying effort of pharmaceutical industries. Accordingly, the under-regulation of the approval process of the FDA for new drugs must be addressed to ensure public health.[108]

C. Striking a Regulatory Balance: The Path to Enlightenment

There is an old saying: "If it doesn't make sense, there must be a buck in it." About 128,000 hospitalized patients die each year from FDA approved drugs, ranking fourth as the leading cause of death.[109] Furthermore, about 2.74 million people have adverse reactions to FDA approved drugs.[110] These numbers represent the problems within "Big Pharma" and the FDA.[111] The process of FDA approval for new drugs must be addressed to remove over-regulation to ensure innovation and promote efficiency, as well as under-regulation to safeguard public health. This

102. *Id*.

103. Zack Kaldveer, *Five Ways the FDA has Failed Consumers on Genetically Engineered Foods*, ORGANIC CONSUMER ASS'N, https://www.organicconsumers.org/news/five-ways-fda-has-failed-consumers-genetically-engineered-foods (last visited July 28, 2017).

104. *Id*.

105. *Id*.

106. *Id*.

107. *See* Andrew Pollack, *Engineered Fish Moves a Step Closer to Approval*, N.Y. TIMES (Dec. 21, 2012), http://www.nytimes.com/2012/12/22/business/gene-altered-fish-moves-closer-to-federal-approval.html?_r=0.

108. *See* Brief for New England Journal of Medicine as Amici Curiae in Support of Respondent, *supra* note 5, at 7.

109. Donald W. Light, *New Prescription Drugs: A Major Health Risk with Few Offsetting Advantages*, HARV. U. (June 27, 2014), http://ethics.harvard.edu/blog/new-prescription-drugs-major-health-risk-few-offsetting-advantages.

110. *Id*.

111. Paul Fassa, *Medical Authority's System Kills: FDA-Approved Drugs Kill Over 100,000 People Annually*, NAT. SOC'Y (July 23, 2013), http://www.nationofchange.org/medical-authority-s-system-kills-fda-approved-drugs-kill-over-100000-people-annually-1375713154.

can be accomplished by privatizing aspects of the FDA, subsidizing pharmaceutical research and development with conditions, and expanding the jurisdiction of the federal circuit court of appeals to hear drug-rejection appeals.

D. Altering the Approval Process to Create Rejections Based on Logic

In a patent application submitted to the United States Patent and Trademark Office, an oath or declaration is required.[112] The oath or declaration requires: "(1) the application was made or was authorized to be made by the affiant or declarant; and (2) such individual believes himself or herself to be the original inventor or an original joint inventor of a claimed invention in the application."[113] Through this oath, the claims of a patent application are presumed true.[114] Thus, an examiner cannot reject a claim because of mere skepticism; rather, the claim must be rejected on grounds of reason and logic.[115] In doing so, the reasoning of the rejection is known to the applicant.[116] As a result, the applicant can make necessary changes, such as amending the claims to then obtain a patent grant,[117] resulting in a furtherance of innovation by disseminating the information of the invention. However, an NDA to the FDA does not require such a declaration or oath.[118] Without an oath or declaration and presumed truth, applications can be rejected for being a "theoretical construct," like Genasense.[119] The rejection of an application for such an abstract reason results in uncertainty and increases the costs of pharmaceutical research and development; thereby, reducing the supply of new and effective drugs.[120] By adopting an oath or declaration requirement, the FDA would take a step forward by basing the approval standards in logic or reasoning. In turn, this would decrease the cost of drug development by allowing pharmaceutical companies to focus on rationality, decreasing the research and development cost of a drug on possible abstract rejection. Decreasing the cost of drug development while holding income steady could increase pharmaceutical's profits. The increase in spending power can then be used to research and develop more drugs, creating a loop effect. Overall, the result would be an increase of available pharmaceutical drugs; therefore, rejections based in logic are paramount to promote efficiency of drug development.

The lack of clear standards the FDA set forth may have resulted in the issue

112. 35 U.S.C. § 111 (2012).
113. 35 U.S.C. § 115 (2012).
114. *See* TorPharm, Inc. v. Ranbaxy Pharm., Inc., 336 F.3d 1322, 1329 (Fed. Cir. 2003).
115. *Id.*
116. *See id.*
117. *See* 37 C.F.R. § 1.121 (2015).
118. *See* 21 C.F.R. § 314.50 (2015) (illustrating an oath or declaration is not listed as a requirement).
119. Faloon & Pogliano, *supra* note 76.
120. *See id.*

of "drug lag."[121] In response to drug lag, there have been several proposals made that rely on non-FDA (third party) reviewers.[122] In other words, the privatization of the FDA's review process is sought.[123]

E. Privatization of the FDA: Solving the Issues of Over-Regulation and Under-Regulation

Privatization of certain FDA functions will resolve the issues of over-regulation by increasing efficiency, decreasing cost, and removing bias.[124] The issues presented by under-regulation would also be resolved as lobbyists' influence decreases, and public health is protected.[125] However, privatization of the FDA presents procedural due process concerns of the Administrative Procedure Act.[126] If Congress passes legislation delegating certain functions of the FDA to private certification and review bodies (PCBs) subject to substantive and procedural control by the FDA, procedural due process should be satisfied by FDA oversight and review.[127] For the following reasons, PCBs should be enacted.

A benefit of PCBs is to address the under-regulation issues of the FDA by reversing the power of lobbyists over the FDA. Currently, the efforts of formed special interest lobbying groups are especially effective since they need only appeal to one body.[128] For example, "the chemical industry . . . has spent more than half of a billion dollars ($572 million) in campaign contributions and lobbying expenditures over the last decade to advance its interests."[129] "Monsanto, [for example] has proven itself as a mighty force in Washington, lobbying heavily against regulation and successfully planting its own employees and former employees in federal positions of power."[130] As a result, decision-making of the FDA has become

121. Charles J. Walsh & Alissa Pyrich, *Rationalizing the Regulation of Prescription Drugs and Medical Devices: Perspectives on Private Certification and Tort Reform*, 48 RUTGERS L. REV. 883, 949 (1996).

122. Carpenter, *supra* note 6, at 61.

123. *Id*.

124. *See id*.

125. Walsh & Pyrich, *supra* note 121, at 1040.

126. *Id*. at 957.

127. *Id*. at 1012.

128. SHAWN GOLDMAN, PRIVATIZATION OF THE FDA: TOWARD A FASTER DRUG APPROVAL PROCESS 7 (2007); HENRY I. MILLER, TO AMERICA'S HEALTH: A PROPOSAL TO REFORM THE FOOD AND DRUG ADMINISTRATION 41 (2000).

129. *Lack of Government Oversight*, JUST LABEL IT!, http://www.justlabelit.org/about-ge-foods-center/the-truth-behind-ge-foods/ (last visited July 28, 2017).

130. Elizabeth G. Hill, *Nature's Harvest or Man's Profit: Environmental Shortcuts in the Deregulation of Genetically Modified Crops*, 44 TEX. TECH. L. REV. 353, 390 (2012); *Monsanto: Influence/ Lobbying*, CORP. WATCH (May 24, 2005), http://www.corporatewatch.org/?lid=209 (documenting the "revolving door" between Monsanto employees and officials from U.S. government regulatory bodies, such as the former lobbyist for Monsanto, Michael Taylor, who was appointed as the FDA Administrator).

increasingly arbitrary.[131] By making the FDA into numerous bodies of PCBs, a company cannot focus on one entity or the revolving door phenomena. Thus, corporate executives and government officials alternating between the public and private sector[132] would be inhibited. Thus, the use of PCBs in the NDA process would result in the process being more independent from lobbyists, and more consistent judgments would be rendered.[133]

The use of PCBs would also solve the issues of over-regulation by increasing efficiency, improving cost, and eliminating bias.[134] PCBs would increase efficiency by expediting the application process considerably.[135] Pharmaceuticals could select and pay their own PCBs, which promotes efficiency through competition and market forces.[136] Thus, the FDA's effect on stifling drug development by being time-consuming and cost-prohibitive would be improved.

The use of PCBs would also address the inherent corruption of self-review and the low-reversibility rate.[137] As previously discussed, the FDA is inherently biased against drug approval due to the asymmetric observability of error, and views drug approval as irreversible from the standpoint of reputation.[138] By assigning a review of an NDA to a PCB and appealing to a different PCB, the reputation concern of the FDA is lessened. In reducing the reputation concern of the FDA, the agency would remove asymmetric observability of error, and thus, be more likely to reverse wrong judgments. The PCB's interest in safeguarding public health would be ensured by market competition[139] and the potential recourse of tort liability for not acting with the proper standard of care. The overall effect of enacting PCBs would be increasing the supply of new and effective drugs at a cheaper price for pharmaceuticals. The more efficient process would also increase profits of the FDA by spending less money per drug at a higher turn-over rate.

The increased income of the FDA could then be used to further address the cost-prohibitive nature of drug development through subsidies. A subsidy is a benefit given by the government to groups or individuals in the form of a cash payment or tax reduction. This is "usually given to remove some type of burden and is often

131. GOLDMAN, *supra* note 128, at 7; MILLER, *supra* note 128, at 41.
132. HARRINGTON, *supra* note 93, at 23; *rBGH*, *supra* note 94.
133. *See* Carpenter, *supra* note 6, at 52.
134. *See id.*
135. Walsh & Pyrich, *supra* note 121, at 1004.
136. *Id.* at 1015.
137. *See* Carpenter, *supra* note 6, at 55-56.
138. *Id.*
139. Walsh & Pyrich, *supra* note 121, at 1015.

considered to be in the interest of the public."[140] The subsidies awarded to the pharmaceuticals would be structured similar to the subsidies awarded to the agricultural sector. In the agricultural sector, there are various ways the government subsidizes the agriculture industry—both monetarily and non-monetarily.[141] These include direct cash payments made to farmer-producers when farm commodity prices fall (to make up for their financial losses) and loans with no penalty for default, which, in effect, are a gift since defaults are not penalized.[142]

Subsidies for pharmaceuticals would include direct cash payments, which would be need-based. Loans would also be made to pharmaceuticals and would carry the benefit of no penalty for default. Direct-cash payments made and loans given would be contingent upon no money being spent on advertising and a reduced patent term for the invention of a new drug. Since the drug development cost is being reduced by public funding, it is necessary to put the invention in public use as soon as reason allows. Therefore, privatization of certain FDA functions will resolve the issues of over-regulation by increasing efficiency, decreasing cost, and removing bias. The issues presented by under-regulation will also be addressed by decreasing lobbyists' influence.

F. Tapering the Primary Jurisdiction Doctrine and Increasing Judicial Review

The process of appealing a rejected NDA to the FDA requires an exhaustion of administrative remedies before judicial review.[143] The doctrine of exhaustion of administrative remedies functions to preserve institutional efficiency in the relationships between agencies and courts by precluding premature and potentially unnecessary judicial intervention in the administrative process.[144] After administrative remedies have been exhausted, the applicant can then seek judicial review.[145]

"Lawsuits against the FDA are difficult to win under normal circumstances."[146] Suits seeking an injunction against the FDA are a waste of the client's money and time. These claims run afoul of the Supreme Court's broad grant of

140. *Subsidy*, INVESTOPEDIA, http://www.investopedia.com/terms/s/subsidy.asp (last visited July 28, 2017).

141. Marc Davis, *Government Subsidies for Business*, INVESTOPEDIA, http://www.investopedia.com/articles/basics/11/introduction-to-government-subsidies.asp (last visited July 28, 2017).

142. *Id*.

143. 21 C.F.R. § 10.45(c) (2015).

144. 20A ALFRED S. NEELY IV, LIMITATIONS ON JUDICIAL REVIEW OF ADMINISTRATIVE ACTION, MO. PRAC., ADMINISTRATIVE PRACTICE & PROCEDURE § 13:4 (4th ed. 2015).

145. 21 C.F.R. § 10.45(b) (2015).

146. 1 KATHARINE A. VAN TASSEL, THE FDA IN COURT: CIVIL ENFORCEMENT ACTIONS, FOOD AND DRUG ADMIN. § 7:42 (4th ed. 2015).

enforcement discretion to the FDA under the primary jurisdiction doctrine.[147] "Essentially, courts applying the primary jurisdiction doctrine have found that requests for injunctive relief involving products regulated by the [FDA] are better addressed by the agency, not the court, and stay or dismiss the claim for injunctive relief pending resolution by the FDA."[148] However, a few federal district courts have refused to invoke the primary jurisdiction doctrine as a bar to state consumer fraud claims involving FDA regulated products, mostly because the courts did not find such determinations required the special competency of the FDA.[149] As the FDA transitions into PCBs, the FDA's role will diminish, and the claims will be better addressed by the court than the FDA.

In practice, suppose a GM cattle was created that could produce omega-3 fatty acids, normally found only in fish. In doing so, a filet mignon would be healthy as a filet of cod.[150] A NDA would be filed with and reviewed by a PCB. If rejected, the applicant would be able to appeal to another PCB. If rejected again, the applicant could appeal to the director of the FDA or file a claim in a district court. If the NDA is approved, the GM cattle that can produce omega-3 fatty acids, could be sold in the United States. This example illustrates the concept of using technology to advance the food supply under an efficient system. Establishing an efficient system is a necessity to meet the demands of a growing population with dwindling resources.

IV. CONCLUSION

Pursuant to *United States v. Pro-Ag, Inc.*, GMOs are classified as a drug and are under the jurisdiction of the FDA.[151] The over-regulation and under-regulation of the FDA leads to uncertain approval methods, delays in the approval of needed therapeutic drugs, and greatly increases the costs of pharmaceutical research.[152] In the process, thousands of lives are being lost.[153] To remedy this harm, the drug approval process must be privatized in certain aspects.[154] In doing so, the approval of therapeutic drugs will be accelerated, the supply of new and effective drugs will be increased, and public health will be safeguarded.[155] Consequently, the standard

147. *Id.*; *e.g.*, Heckler v. Chaney, 470 U.S. 821, 838 (1985) (holding Congress intends to allow broad discretion for its administrative agencies to make particular enforcement decisions).

148. William V. Essig, *Recognizing the Agency's Special Competence: The Primary Jurisdiction Doctrine*, 45 NO. 7 DRI VOICE DEF. B. 54, 2003, at 3.

149. *Id.*

150. *Genetically Modified Crops*, *supra* note 35.

151. United States v. Pro-Ag, Inc., 968 F.2d 681, 682 (8th Cir. 1992).

152. *Judgments About the FDA*, *supra* note 53.

153. Faloon & Pogliano, *supra* note 76 (explaining how the delay of Provenge costed approximately 82,000 lives).

154. *See* Walsh & Pyrich, *supra* note 121, at 949.

155. *See* Carpenter, *supra* note 6, at 52.

of living in the future will be elevated by ensuring basic necessities and avoiding needless suffering.[156]

156. Finnemore, *supra* note 1, at 37.