

Juniper Berries and Brownian Motion: Plants, Chaos, and a Fractaled History of Abortion in the
Brigham Family Receipt Book

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Thomasina: God's truth, Septimus, if there is an equation for a curve like a bell, there must be an equation for one like a bluebell, and if a bluebell, why not a rose? Do we believe nature is written in numbers?

Septimus: We do.

Thomasina: Then why do your equations only describe the shape of manufacture?

Septimus: I do not know.

Thomasina: Armed thus, God could only make a cabinet.

– Tom Stoppard, *Arcadia*¹

We historians have two glaring impediments that we cannot seem to conquer: we are obsessed with categorizing, and we fear chaos. Today, I present one element of this problem, suggest mathematics—that usually ordered thing—as a solution, then flip that solution's orderliness on its head and suggest that the very chaos we fear is our only solution. To understand what I mean, I will take one of my favorite historical topics as my target: abortion. One of the profound effects of our modern obsession with sorting, with pathologizing, with categorizing, is that we often carry this obsession, usually subconsciously, with us when we examine the past. Historians *know* this is a faux pas, and actively avoid it, at least nominally. But in several subdisciplines of history, we constantly rely on our modern categorizations despite repeatedly insisting that we are not doing so. Modern US legal codes define abortion generally as the voluntary termination of a pregnancy, a broad and simple identification that can (and does) allow for mass conviction on little to no legal basis. But even ardent pro-choice historians such as myself want a definition, a category in which to place the concept, if only to prevent the strong arm of the law from labeling miscarriage or stillbirth as felonious. But our inability to do so is doing a disservice, and it represents us falling into a dangerous trap: it makes us see historical abortion as rare, illicit,

¹ Tom Stoppard, *Arcadia: A Play in Two Acts*, Faber and Faber, London, 1993, 37.

perpetually voluntary, and *perpetually* illegal. But I think mathematics, plants, and the late-great twentieth-century playwright, Tom Stoppard, can help us with our problems just a bit.

When I say that our propensity to categorize and label “abortion” is harming us, and how I propose we stop harming *us*, I ask you to look outside; hopefully you have access to a window, or, even better, are outdoors already. Look at the first plant you see, and think for a moment. Micheal Marder, philosopher of the vegetal, points out in his article “A Philosophy of Stories Plants Tell” that the Greek *muthos*, broadly storytelling, is often conceived of as diametrically opposed to and defeated by *logos*, broadly reason. But is that even possible, asks Marder, when *muthos* is not mappable, but rather a structurally living, dynamic, and organic concept? *Logos* cannot defeat *muthos*, not wholly, argues Marder, because the latter is “rooted more deeply than *logos* itself in a life of another kind, following a different figuration or configuration.” That “different figuration” is vegetal. Plant-like. Uncategorizable. We have never thought to study the vegetal, because we see plants as less important than humans and animals, and thus less varied and ripe for philosophizing. What can the vegetal teach us that we did not already know?

Plants, or nature more generally, also gave us fractal geometry, a means to understand the construction of the natural world and all that exists within it. Fractal geometry posits that symmetry will remain the same despite contraction or dilation. It used to be that the variation of nature’s shapes seemed geometrically chaotic and unscientific: our lack of a harness on fractal geometry explains why, in the words of fractal geometry pioneer Benoit Mandelbrot, “the oldest concerns of Man, such as concerns with the shapes of mountains, clouds and trees...had not led to sciences comparable in effectiveness to the physics of smooth phenomena.”² Mandelbrot explains mathematical and natural fractals as “shapes whose roughness and fragmentation *neither* tend to vanish, *nor* fluctuate up and down, but remain essentially *unchanged* as one zooms in continually and examination is refined.” In other words, “the structure of every piece holds the key to the whole structure.”³ Each part is a reduction of the whole, and contains its own parts which are in turn reductions of the whole, for an infinite number of contractions and dilations. Think the fern, or a craggy mountaintop. Jeremy Colangelo explains the Julia set,

² Benoit B. Mandelbrot, “Fractal Geometry: What is it, and what does it do?,” *Proceedings of the Royal Society of London. A. Mathematical and Physical Sciences* 423, no. 1864 (1989), 4.

³ Mandelbrot, “Fractal Geometry,” 4.

similar to Mandelbrot's function, as follows: "Choose an arbitrary point, z , square it, and add c , which then becomes the second z ; mark each point on your graph, and if the first point is inside the set, all subsequent points will be as well [$fc(z) = z^2 + c$]." ⁴

Tom Stoppard's play *Arcadia* asks us to think of time and history as fractals, unchanging but mirroring, and I will attempt to catch his passed baton and do something with it. I cannot describe Stoppard's play in the detail it deserves, so I implore you to read it. *Arcadia* pushes us past the simple mathematical definition of fractal geometry, and instead asks us to consider it in terms of history and language; what it *really* tells us is that fractals, despite their reductions of the whole on for infinity, are inherently unpredictable. Chaotic. Colangelo likens it to Brownian motion, which is motion without tendency, without expectation. It is "as close to pure randomness as one can find in nature," and generates, when we consider it, "an inescapable tension, a promise of sorts that what we expect to happen likely will not." ⁵ Despite their admitted symmetry and perpetual expansion and contraction, we cannot predict where the next point of a fractal will be, just as we cannot predict what the next historical event will be. Brownian motion and fractal geometry ask us to consider the distortions of history, particularly the minor ones, as, in Colangelo's words, "molecules bumping against the pollen" of a fractaled past. If we miss those molecules, our image of the pollen will be a fantasy. If we imagine those molecules to mirror the ones that bump against our pollen in modernity, we will have an image of an oxymoronically predictably unpredictable pollen. Bad history, in other words.

So, I ask you to bear with me as I attempt to use fractal geometry and the seventeenth-century reproductive cures contained in the receipt book of the Brigham family of Massachusetts to explain my suggestions about studying the history of abortion. The receipt book archive is one which is bafflingly simple, but deeply complicated; it encourages us to examine not only the materiality of texts, but also the practices of household management and its hand in early modern knowledge making and practice. Building on Pamela Smith—who in her 2004 field-defining monograph *The Body of the Artisan* argued that artisans' labor and material interaction with nature constitute a 'scientific' means of 'knowing nature,' or, in other words, that *making* is a (or

⁴ Jeremy Colangelo, "The Mote in God's *i*: Fourier, Fractals, and Imaginary Numbers in Tom Stoppard's *Arcadia*," *Modern Drama* 62, no. 2 (2019), 192.

⁵ Colangelo, "The Mote," 193.

the) means of *knowing*—Elaine Leong’s 2018 book *Recipes and Everyday Knowledge: Medicine, Science, and the Household in Early Modern England* argues that “the production and circulation of recipes” is a means to understand the knowledge processes of “household science,” or “quotidian home-based investigations of the natural world” or, broadly, “everyday knowledge.”⁶ The genre of the early modern receipt book is itself fractal and thus uncategorizable: it represents a lack of division between the alimentary and the medicinal, all of which exist within a realm of functionality predicated upon the transmission of knowledge between neighbors, family members, and more. The receipt book contains practically applicable knowledge and invites repeated experimentation by different users.

The bulk of healthcare in the early modern period consisted of home-based medicine, meaning female “medicine makers” were highly valued for their skills and, as a result, created links with their community due to their necessity.⁷ The receipt book not only implies a relationship between the women amongst whom it was circulated, but also the writer and the reader. Literary historian Wendy Wall argues for the existence of “contractual relationship” between the two, one that is based in the linguistic roots of the term “receipt.”⁸ The Latin “*recipere*” and imperative “*recipe*” imply a “call to action” in which the reader must take information and embody it; fundamentally, it is a physical act that implies the production and consumption of that which is recorded in the pages, hence the proliferation of “recipe” in the modern “Rx” symbol.

The provenance of a receipt book can be difficult to track, due to its generational and shared nature, as will be demonstrated in the Brigham case. A single receipt book, often created from the unused male commonplace book, could change hands many times during the period of use, sometimes over centuries. Handwriting will change, and often there is very little record of to whom the book has been given. Often, comments in various hands will be made upon certain recipes, indicating their success or failure. Additional recipes could be collected from friends and

⁶ Elaine Leong, *Recipes and Everyday Knowledge: Medicine, Science, and the Household in Early Modern England*, University of Chicago Press, 2019, 4.

⁷ Elaine Leong, “Making Medicines in the Early Modern Household,” *Bulletin of the History of Medicine* 82, no. 1 (2008), 147.

⁸ Wendy Wall, *Recipes for Thought : Knowledge and Taste in the Early Modern English Kitchen*, Philadelphia: University of Pennsylvania Press, 2016, 14.

family to be added to the books.⁹ In a largely oral world, particularly for the less literate female population, a recipe need only be recorded if it was unusual, requiring some kind of extraordinary memory; as Wendy Wall writes, “perhaps only things precisely outside a maker’s everyday repertoire.”¹⁰ These recipes represent a transitional space, the movement from “raw to cooked” or even “nature to art, from shapeless *materia* to cultural product.”¹¹ They are never *done*, per se, even if the meal is cooked or the medicine distilled. Like heat, the tangible creation of the recipe must decay and return to waste and shapeless *materia*, its energy never dissipating but expanding outward into a new fractaled form of natural existence.

Historians tend to order this variety of supposedly “domestic” healing, arguing that early modern women knew cures and often diagnoses, but did not understand the complicated science behind them. I cannot help but dislike this admittedly persuasive division. Will it be how future historians designate my study of the history of medicine? As elementary, merely touching upon medical knowledge but never quite getting a handle on true, masculine, empirical and material *Science*. Historian Rebecca Tannenbaum put it as follows in 2002: “when a housewife gave willow bark to a child and lowered a fever, it was more like harnessing an incomprehensible force than seeking forbidden knowledge.”¹² Again, it is hard to find evidence to dispute this, and Tannenbaum is working brilliantly with her sources. Her book describes myriad medical contributions of early American women, and yet, this statement clouds our excitement, certainly, because we simply cannot find historical sources describing early modern women being provided with robust medical educations. So maybe we have a philosophical problem, one that fractals, plant philosophy, and a refusal to categorize can help us out with.

Let us presuppose that the traditional concept of geometric order is to the novel concept of fractal geometric order as “traditional” and “learned” early modern science is to women’s “domestic” medicine. Even better, what if I told you that the early modern receipt book *is* fractaled in nature? For explanation’s sake, let us consider that seventeenth century receipt book

⁹ Elaine Leong, “Collecting Knowledge for the Family: Recipes, Gender and Practical Knowledge in the Early Modern English Household,” *Centaurus* 55, no. 2 (2013), 94.

¹⁰ Wall, *Recipes for Thought*, 5.

¹¹ Wall, *Recipes for Thought*, 5.

¹² Rebecca Jo Tannenbaum, *The Healer's Calling: Women and Medicine in Early New England*, Cornell University Press, 2002, 19.

I mentioned earlier. Owned at in the 1650s—probably in England—by an “Anna Cromwell,” and intensely annotated by an “A.W.,” who Tannenbaum argues was Cromwell’s sister, the Brigham family receipt book entered its namesake family through Elizabeth Howe Brigham in the late seventeenth century.¹³ Howe Brigham married Captain Samuel Brigham of Marlborough, Massachusetts in approximately 1660. She was the daughter of Roxbury settlers, Abraham and Hannah Ward Howe (“Ward” may be a connection to the elusive and loquacious “A.W.,” but there is no way to be certain there).¹⁴ Two of Elizabeth and Samuel’s sons, Timothy and Charles, respectively married Sarah Prentice Brigham and Mary Peters Brigham around 1700.¹⁵ Both of these women were the inheritors of the receipt book after Howe Brigham’s death.¹⁶ Their communal and cross-generational book contains nearly endless cookery and medicinal recipes, including a very good many reproductive cures.

So, as promised, I will now use the Brigham receipt book to explain why our obscured understanding of early modern reproductive medicine is making us misunderstand the history of abortion, and, more broadly, how the fractaled nature of the receipt book’s reproductive contents can help us to know the historical body better (if we can ever know it, which, we really cannot, can we?). Tannenbaum posits, echoing other historians, that two of the reproductive recipes in the Brigham book *could* be abortifacient medicines: Recipe 103 in Folder 4, and Recipe 12 in Folder 5. The former is titled “to cleanse the womb,” and contains common abortifacient ingredients: juniper, mugwort, mother of thyme, madder root, motherwort, and saffron.¹⁷ The latter claims to be for the purposes of healing “any outward or inward wound,” but contains a marginal note that reads as follows: “Let no woman with child drink this, for it will help to do the office of a midwife.”¹⁸

Tannenbaum argues that we really cannot say whether either or both of these were used as abortifacients, particularly because the humoral system of medicine held that obstructed

¹³ Tannenbaum, *The Healer’s Calling*, 23.

¹⁴ William Irving Tyler Brigham, *The History of the Brigham Family: A Record of Several Thousand Descendants of Thomas Brigham the Emigrant, 1603-1653*, New York: The Grafton Press, 1907, 80.

¹⁵ Brigham, *The History*, 92-93.

¹⁶ Tannenbaum, *The Healer’s Calling*, 23.

¹⁷ Tannenbaum, *The Healer’s Calling*, 37.

¹⁸ Multiple authors. *Anna Cromwell English Recipe Book*, in the Charles Brigham Family Account Book, American Antiquarian Society Library, Mss. Folio Vols. B, 1650s-1730s, Folder Two, p.44, recipe 12.

menses were a sign of obstructed humors, meaning that the use of emmenagogues—agents stimulating menstruation—were perhaps quite broad.¹⁹ Humors could mutate and intermingle irregularly, but any superfluidity or dearth spelled medical danger. Age, constitution, season, and diet all affected humoral balance, but so too did the six non-naturals, which were said to maintain health.²⁰ Blood was the most important humor, as it had a central role in heat distribution, the manna of human life. It acted as a conduit for its own humor and the three others, and this visual and empirical diagnostic practice meant that Europeans had a very determined notion of how to ensure a medication was effective: if it purges, it works. The healing patient should be vomiting, bleeding, urinating, defecating, sweating, or crying. This meant that the “flow” of the body was enacted again, the humors rigorously working to right themselves.

Ulinka Rublack remarks on the focus on early modern “bodily fluids and juices” and their “motions, interruptions, consistency and purity in interaction with heat, cold, emotions, nourishment and movement,” arguing that the “‘flow’ [of the body] [was] the juice of life.”²¹ This flow *moves*, ordinarily in one direction, but it is far from predictable. The purging patient must be monitored around the clock; any one molecule can disturb that supposedly predictable fractaled pattern of the pollen (or the body, in this case). Historically contingent events which *would* disturb that pollen, the “flow” of the female body, are not going to be picked up by historians because we do not recognize the molecules as agents. We do not see fright or a sunny day as affecting menstrual flow, just as we do not see the millenia of erosion beneath a waterfall that affects its fractal expansion and changes both its direction and its identity. Brownian motion tells us that this flow is *not* predictable: it presents us with that aforementioned “inescapable tension,” where we know that “what we expect to happen likely will not.”²²

There was much to the humoral body, particularly that of the humoral woman’s body, that was predicated on unpredictability. She was fractaled in many ways, nearly herself representing the pollen that one molecule can scatter. Her body existed porously and inextricably in the world, subject to threats or minutely invisible effects not only on the surface of her skin,

¹⁹ Tannenbaum, *The Healer’s Calling* 37-38

²⁰ These included food and drink, exercise and rest, air, sleep, evacuation, and emotions. Occasionally, it also included regular sexual intercourse (Noga Arikha, *Passions and Tempers: A History of the Humours*, New York: Harper Collins, 2007, 77).

²¹ Ulinka Rublack, “Fluxes: the Early Modern Body and the Emotions,” *History Workshop Journal*, 53, no. 1, (Spring 2002), 1-2

²² Colangelo, “The Mote” 193.

but beneath its tender porousness. The humoral woman was cold and moist, which supposedly rendered her passive, gentle, tender, and kind, and meant that her body was dangerously subject to disease due to its porosity and permeability.²³ Much of the female body's organization and survival was linked to her heat, blood flow, womb, and seed, and thus to her menstrual capabilities. Female seed, due to minimal heat, was less purified than the man's,²⁴ and women menstruated due to their body's inefficiency to purify and evacuate blood.²⁵ Humorally "hot" herbs could provoke the menses, or simply address problems with the "mother" or "matrix," because the fetus was composed of and nourished by the woman's blood.²⁶ That surplus blood would then be converted into breastmilk, used to feed the infant and for various medical purposes.²⁷

If one must recall one thing about this complicated and fragile female physiology, it should be, as Laurence Totelin puts it, that "a woman's life is marked by fluxes, healthy or otherwise." These include menstruation, the lochial, or blood discharge following birth, lactation, and general illness.²⁸ So, considering the centrality of flow to the early modern female body, historians must *broadly* consider the use of abortifacients or emmenagogues—herbal agents which increase blood circulation to the pelvic area, cause uterine contractions and stimulate menstruation²⁹—without being clouded by our modern understanding of abortion (or emmenagogues), which is comparatively black and white. The effects of these herbal agents were not biologically determined and catalogued as they are today, but rather acted on the woman's body like the molecule on the pollen: even if early modern individuals could predict the pattern of the fractaled female body, we cannot, because we cannot see all those little molecules acting on the pollen. Women too full of blood *needed* it evacuated, even if they were

²³ Sara Heller Mendelson and Patricia Crawford, *Women in Early Modern England, 1550-1720*, Oxford: Clarendon Press, 1998, 20.

²⁴ By the end of the seventeenth century, William Harvey's *On Generation* led to the belief that women did not possess seed, (Mendelson and Crawford, *Women in Early Modern England*, 20).

²⁵ Mendelson and Crawford, *Women in Early Modern England*, 20-21.

²⁶ Mendelson and Crawford, *Women in Early Modern England*, 28

²⁷ Patricia Crawford, *Blood, Bodies, and Families in Early Modern England*, Routledge, 2015, 1.

²⁸ Laurence M.V. Totelin, "A Woman in Flux: Fluidity in Hippocratic Gynaecology," in *Holism in Ancient Medicine and Its Reception*, ed. Chiara Thumiger, *Studies in Ancient Medicine*: 53. Brill, 2021, 220.

²⁹ Dinesh Kumar, Ajay Kumar, and Om Prakash, "Potential Antifertility Agents from Plants: A Comprehensive Review," *Journal of Ethnopharmacology* 140, no. 1 (2012): 1-32).

pregnant (which may seem counter-intuitive to the modern mind). So, then, we see that expulsion of a fetus with the use of humorally hot herbs need not *always* be for abortifacient purposes. Deceased fetuses needed to be removed from the mother's body, meaning that herbal menstrual stimulants were invaluable. The danger of not removing the afterbirth after delivery hung heavy over the heads of early modern women: postpartum hemorrhage, or "bloody flux" after delivery, was almost certainly a death sentence, to say nothing of resulting childbed fevers and infections. Emmenagogues, abortifacients, and other menstruation provoking herbs, then as they do now, symbolized the choice between life and death.

Tannenbaum's assessment of the Brigham recipes recognizes all this above, but also points out a major issue in the historiography of reproductive care: even though we *know* that we should not, we repeatedly insist on labeling recipes for one purpose or another. We seek out the abortifacients, which means we miss the fact that their supposed opposites, those cures which aid in childbirth. We are finding half the molecules bumping against the pollen, then wondering why the pollen is moving and expanding in the opposite direction. We are missing most of the historical contingencies.

If women truly were not concerned with questions of broad medical theory, then, it need not mean that they were ignorant in any way: what it may mean is that we are comparing them to the wrong *thing*, to dominant male medical theory. Could we not instead posit that their reproductive medicine symbolized its own medical discipline, one which certainly clung to Galenic humoralism but was synthesized with real world experience, and predicated on the inducement of sanguineous flow? To experiment with this question, I compared the ingredients of the two aforementioned Brigham recipes with two others from the family's book: Recipe 21 of Folder 2 is to aid "women in their labor," and Recipe 34 of the same folder is "to give to women with childe, & in childbed," among other things. These two would be skipped over in a term search for recipes specifically for abortifacient purposes, even if they could ostensibly be used for late term abortion in addition to facilitating labor and delivery. Basic statistics, when comparing all four recipes, are as follows: 40/59 ingredients are unique to Rx 21; 12/26 ingredients are unique to Rx 34; 5/9 ingredients are unique to Rx 103; and 11/21 ingredients are unique to Rx 12. The ingredients that are shared are those most commonly used to induce menstrual bleeding or abortion: sage, rosemary, rue, elecampane, mother of thyme, juniper

berries, mugwort, and more. Those not shared primarily include chemical ingredients that were harder to source, or flavorings to make the distillation go down smoother. So why are historians not including Rx 21 and Rx 34 of the Brigham book as potentially abortifacient recipes? Because they are not labeled as such?

Let us use those nifty fractals to get at the answer to this question: imagine the early modern female body as a shape, perhaps a triangle, filled with identical triangles which themselves are filled with identical triangles which are themselves filled with identical triangles, and on and on infinitesimally. Place beside that body a receipt book, filled with medicinal recipes that are in microcosm books filled with medicinal recipes; or, perhaps less complicated, imagine the receipt book to be a “cure,” filled with recipes which are independently “cures,” which are in turn filled with ingredients which are independently “cures,” which are in turn filled with biological matter which are independently “cures.” Once we have zoomed all the way in on that biological matter, which for all intents and purposes can represent the most minute fractal visible to the human eye, we can zoom back in: the biological matter is “stuff,” which makes up the “stuff” of the humors, which makes up the “stuff” of the balanced humoral body, which makes up the “stuff” of the female body. Fractally. In the Julia set [$f_c(z) = z^2 + c$], it could be imagined as c , a cure, acting upon z , the body. They are together and separate, acting and acted upon, and predictably unpredictable.

When we consider both the receipt book and the female body as fractaled, we can see that our categories and designations are rather silly. We should not be searching for abortifacients in the early modern receipt book, because no one thing is ever one thing: it is made up of many other things, snuggled together in a fractaled shape that can and would continue expanding (if, say, a member of the Brigham family still used it and filled it in), predictably but affected by unpredictable molecules of the historical, minor and major and everything in between. That which can cause an abortion, which we define in our modern minds as voluntary termination of a pregnancy, seems at first to be diametrically opposed to that which can help facilitate healthy birth, or promote lactation, or aid mental health. But it is not, at least in the worldview of the early modern woman. Because time, and history, like fractals and Brownian motion, are *not* predictable. Minute and unobservable phenomena affect them; Elizabeth Howe Brigham may once have miscarried after taking a dose of Rx 12 for stomach pain, something she might never

have noted down but would have had a *profound* effect on the history of abortion that we construct today.

The Brigham women were deeply concerned with reproductive health. A quick perusal of their book reveals over seven recipes for “fits of the mother,” and abortifacient ingredients predominate the medicinal section. They admittedly rarely muse on the causes or “scientific” background of their cures. In his ethnohistory of Iroquois medicine from the 1990s, James Herrick explains that the search for causes of illness when studying Indigenous American medicine is a fruitless pursuit; he states that “it is only after a philosophical break is made from an insistence upon specific causes for specific symptoms or syndromes that the frustrations of studying non-Western medical beliefs are relieved.”³⁰ I would argue that it would benefit the history of medicine to engage in that very same philosophical break when it comes to our view of historical reproductive health. We think of the body, whether modern or historical, as a cloud of pollen being acted upon by one single molecule (“illness”) that pushes it to the left, and “medicine” as another single molecule that pushes the pollen back to the right. A ping pong game of human health. But that just is not accurate, at least when it comes to early modern reproductive medicine. Hundreds and thousands of molecules pound and brush and hurl and whisper themselves against the pollen, shifting it and shaping it into patterns we could not have imagined. Dodgeball, perhaps.

We should look instead to the plants, the vegetal and fractaled natural world. Plants burrow downward, defying *logos* and typifying *muthos*; they geometrically expand in initially inexplicable ways, somehow both symmetrical but also chaotic. Early modern reproductive medicine is a fractaled plant, just as the body, modern or early modern, is itself also biological and fractaled. We cannot categorize one cure as separate from another in early modern domestic reproductive care, because it sits beside an identical, but perhaps upside-down cure, and makes up an entire world of cures. It is unpredictable, uncategorizable, and perpetually expanding. It sounds scary, but what a world of possibilities it allows us to imagine. We are pollen, with a planned direction in mind, but the winds of time will not cease sending its molecules to bounce against our fragrant cloud. Who are we to try to control the whims of nature

³⁰James W. Herrick, *Iroquois Medical Botany*. Syracuse University Press, 1995, 26.

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