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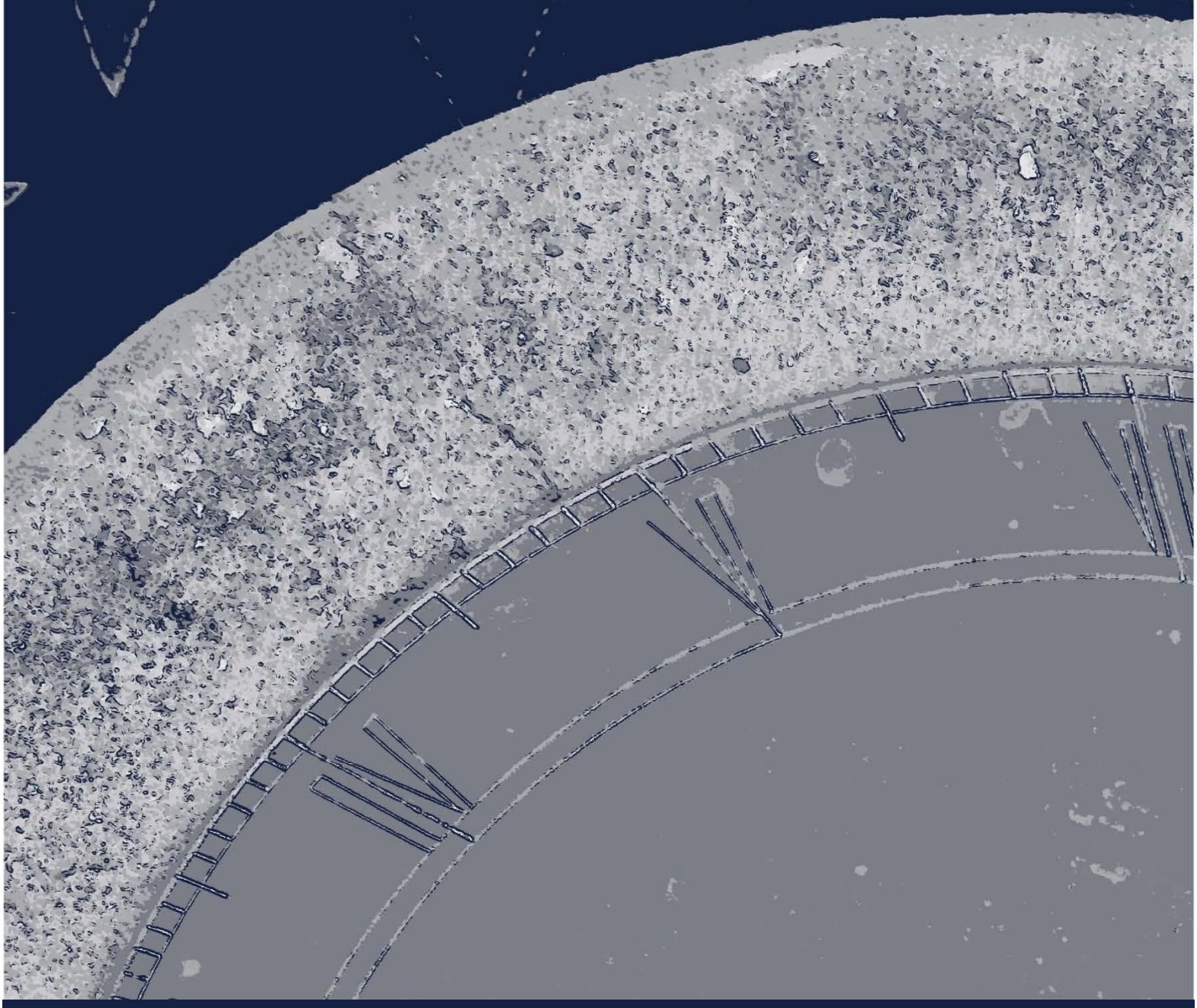

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The Arsenal was initiated by On the Shoulder of Giants in Fall 2016. The journal represents and highlights undergraduate research of academic and scholarly value from various disciplines at Augusta University. Each article undergoes a peer-review process facilitated by the journal's Editorial Review Board and must be approved by an appointed faculty reviewer in the article's respective discipline.

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Looking to the Stars: Millennials and Astrology

Barbara Kempton

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Looking to the Stars: Millennials and Astrology

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ABSTRACT This essay presents an argument on millennial interest in New Age spirituality, in particular astrology. This project culminated from an assignment of the Drawing II course in the spring 2018 semester, which included a short paper on a research topic of interest, and a drawing.

Keywords: millennials, astrology, spirituality, drawing

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Looking to the Stars: Millennials and Astrology

Each American generation has been generalized by their attitudes and values. Baby boomers are considered optimistic and individualistic, while millennials are considered pragmatic and full of entrepreneur spirit. As millennials are often labeled through the lens of the older generation, the stereotypes associated with this group are often negative in nature; millennials are seen as lazy, narcissistic, and materialistic. By definition, a millennial in the United States is someone who was born between the early 1980s to the early 2000s. Putting negative stereotypes aside, a decade of research shows that this generation is more likely to be open to other viewpoints, technologically savvy, concerned with reproductive rights, and supportive of equal rights for minorities and the LGBTQ+ community. Millennials are also considered to be the least religious in comparison to earlier generations – a whopping 29 percent are not affiliated with religion (Lundin, 2019). However, there has been a facet of millennial culture that seems to contradict this statistic.

Millennials show an increased interest in spirituality not necessarily tied to organized religion. In a discussion on millennial allegiance to astrology, Keri Paul (2017) cites a study finding from IBIS World that the psychic grew 2 percent between 2011 and 2016 and is worth $2 billion annually. Astrology appears to be the most widespread and visible form of occult practice within mainstream culture today. In an interview with *The Atlantic*, Chani Nicholas, an astrologer based in Los Angeles, claims that "there's something that's happened in the last five years that's given it an edginess, a relevance for this time and place, that it hasn't had for a good 35 years. Millennials have taken it and run with it" (Beck, 2018). Why are millennials leaning towards these non-empirical methods of answering questions, those of which can be undeniably called pseudoscience in today's world? This essay will discuss why millennials are so drawn to these "psychic services," and to astrology in particular. The visual representation portion of this research project will display astrological imagery and ideas within the context of the modern world using each of the twelve zodiac signs of Western Astrology.

Astrology dates back to the 2nd millennium BCE and has been used by many cultures such as the Indians, Chinese, and the Maya. However, the type of astrology concerned in this paper, which is popular in American culture today, is Western Astrology. Western Astrology can base its roots back to 19th-17th century BCE Mesopotamia. Occult imagery carries a mystic and symbolic quality; the archaic style background in which the signs are typically illustrated will be avoided and instead will be displayed in a variety of settings found in modern reality. This juxtaposition of

aesthetics should "visually disenchant" the viewer while attempting to create a visual for how such a disenchantment would look. Avoiding aesthetics that would indicate other-worldliness and instead trapping each zodiac sign in a modern environment points to a more holistic and honest representation of the millennial generation and its relation to astrology.

Before explaining why the millennial generation is drawn to astrology, a wider, more philosophical approach concerning Western society's changing relationship with religion will be discussed first. Religion is a subject of concern in this research because the "loss" of it in modern society has left a gap in issues of morals that science and philosophy cannot fill. Modern philosophers and thinkers have written extensively on the "loss" religion has left on modern society. The concept of disenchantment, first theorized by social theorist Max Weber (1963), describes the opposed roles of religion and science in today's increasingly secular world. Science is now more highly valued than belief, but this shift has left a sense of loss. *Entzauberung*, the German translation of this concept, literally means "removing the magic." Because the world is increasingly perceived in a more rational matter, there is no "rose-colored glasses" way of thinking.

Religious institutions themselves have not been immune to this disenchantment, which may point to why Westerners are rejecting these institutions. Danish Philosopher Søren Kierkegaard describes the modern condition as a lack of "passion." In his book, *Concluding Unscientific Postscript to Philosophical Fragments*, he compares the Christian who worships the "true" god to the pagan who worships an idol. The Christian takes great measures to worship with objectivity, while the pagan takes all means to worship with passion – the Christian prays with untruth and the pagan with truth. The Christian's worship is a matter of what and who, while the pagan's worship is a matter of how. Like Kierkegaard's Christian, the modern world is more concerned with the rationality and "what" of it all. Philosopher Frederic Nietzsche's concept of the "death of God" describes man's loss of religion and man having to accept this loss. He states that this "death of God" results in the loss of traditional values, which he theorizes would lead to despair and nihilism, a lack of meaning for life. Nietzsche states in *The Gay Science* that "we have become cold, hard, and tough in the realization that the way of this world is anything but divine; even by human standards it is not rational, merciful, or just." In understanding and acknowledging that a certain passion, trust in belief, and given meaning has been lost in modern times, one can begin to seek why millennials are searching for ways to regain these ideas. The increased popularity of a spiritual outlet such as astrology serves as a substitute for the space religion once filled.

With the concept of disenchantment serving as a basis of understanding for the modern condition, one can begin to dissect the societal conditions directly related to the millennials that would cause attraction to astrology. In addition to the aforementioned

loss of "magic" in modern society, there seems to be an extra layer of stress in today's world added onto the already disenchanting modern condition. According to survey data from the American Psychological Association (2017), millennials are the most stressed generation since 2014, and are also the generation most likely to say their stress has increased since 2010. This stress stems from multiple factors. Politics is one – the political tumult within American society that increased tenfold since the 2016 election has increased stress levels not only in millennials but in every generation (American Psychological Association, 2017). Another factor is difficult economic circumstances. A study conducted after the 2007-2009 recession revealed that associations between economic stressors and symptoms of both depression and anxiety were significantly greater for millennials compared with baby boomers (Brown et al., 2017). This difference is explained by the older generation's tendency to use active coping strategies in comparison to the younger generation (Brown, Richmand, & Rospenda, 2017).

The correlation between astrology's increased popularity among millennials and their prevalent stress levels indicates that astrology could be serving as a coping mechanism. A small psychological study by Graham Tyson (1982) found that people who consulted astrologers often did so in response to stressors in their lives. Under conditions of high stress, individuals use astrology as a coping device, though they wouldn't under low stress (Tyson, 1982). The study also found that those stressors were often stemmed from the results of a person's lack of social skills. Social media use, which millennials are the most active participants of, can increase levels of depression and anxiety among its users, factors that could potentially lead to a lack of social skills in an individual (Cain, 2018).

Astrology functions as a suitable coping mechanism for a multitude of reasons. The barrier of entry is nearly non-existent and there is a wide expanse of knowledge on the subject online, making it perfect for the Google-fluent millennial. Furthermore, astrology is specific enough to have some credibility and to provide a sense of guidance, while also vague enough to allow each individual to cater to their own ideals and circumstances. This flexibility offers a refreshing release from the stringent guidelines a religion may impose on an individual. It also gives people a narrative to follow, providing a possible explanation into the scary unknown that is the future (Beck, 2018). It carries no strong racial or national ties, at least the brand of internet-age astrology one may see today; thus, it is capable of crossing demographic boundaries and reaching a wide audience.

For the visual portion of this research, the zodiac signs are represented on tarot cards. The tarot is similar in astrology in that it is an occult method of divination, which is the practice of seeking knowledge of the future. The zodiac and tarot card are known for having subsets of personality archetypes, a subject easily digestible by the more inward searching millennial generation. The significance of the environment in which the signs

are placed is explained in relation to the modern world.

Aries, represented by the ram, is shown in an anger management class. Anger management programs are based off the research of psychologists and is a form of psychotherapy. This is relevant to the modern world as psychology is a new science in comparison to other fields such as physics and chemistry.

Taurus is represented by the bull. Associated with decadence and love of food, Taurus is shown as a cow with a bolt to its head, the typical method of killing a cow for harvest in the factory farming industry (Safran Foer, 2009) The ethical debate on meat consumption has been around before modernity; however, in today's world, the debate is more focused on the ethics within the factory farming industry rather than the concept of eating meat itself (Safran Foer, 2009).

Gemini is represented as twins. They are shown receiving Botox shots to their foreheads – Gemini is a youth oriented sign and diminished energy tends to bother them. The world's obsession with staying young and beautiful is portrayed through this imagery.

Cancer the crab is shown crawling around a very disorganized room. Cancers are homebodies and like to keep this space organized. The image of a disorganized, messy room is a trope synonymous with symbolism in the modern world: it could signal to some kind of genius, as Albert Einstein and Steve Jobs were purported to have messy desks (James, 2017). The messy room is also associated with depression, the illness that often negatively affects motivation and energy.

Leo is shown as a lion performing for a circus. Leos are the most prideful type, and they dislike taking orders. They tend to carry themselves with dignity and nobility. The use of exotic animals for entertainment has been around since the ancient era – campaigns today by animal rights movements such as PETA attempt to bring awareness to the inhumane treatment of circus animals.

Virgo is represented by the Virgin Maiden. Associated with cautious types, Virgo is shown being bullied in a school setting. One note in a locker reads "VIRGIN LOSER," a play on the sign's virgin symbolization. Virgos dislike both impoliteness and invasion of privacy, and thus the bullying locker note is used as its portrayal. Although bullying is not a new development in human history, this imagery illustrates the heightened awareness of bullying and its repercussions in today's school systems.

Libra is shown as a scale. Instead of using the classical scale image, a modern scale like those found in today's households is displayed as a form of visual disenchantment. On it says "FAT." The Libra is a lover of the aesthete and beauty – an unhealthy fixation on this could result in eating disorders, another prevalent issue in modern society (McBain, 2018).

Scorpio is shown being stabbed in the back – they dislike disloyalty. The Scorpio is

stabbed in the back with a skewer, a play on the scorpion delicacy served in some Asian cuisines. Typically known as mysterious and enigmatic types, portraying Scorpio as a mere snack item functions to disrupt this notion with satire.

Sagittarius, represented by the Centaur, is known for its wanderlust personality. He is shown going through the ever so mind numbing process of TSA (Transportation Security Administration) at an airport. TSA is notorious for its increased security measures implemented since 9/11, an event that not every millennial remembers but have all experienced the aftermath of (Scott, Poulin, & Silver, 2013).

Capricorn, represented by the sea-goat, is shown in a room in which people are partaking in public love making. The Capricorn is the most traditional of the types. He dislikes public displays of passion. Millennials have been the most progressive generation when it comes to issues of sexuality (Lundin, 2019). This imagery twists and perverts this subject around in a negative portrayal.

Aquarius is shown in solitary confinement. They are a type who loves freedom and are ultimately humanitarians. Solitary confinement is a controversial topic concerning the ethics of imprisonment. Some argue that it is a cruel and unjust punishment (Reassessing Solitary Confinement, 2012).

Lastly, Pisces, represented as a pair of fish, is shown caught in a crowded net with other fish. The Pisces is one of the most introspective signs and treasure their alone time, so a very confined space with others would be a nightmare.

Figure 1: Illustration composed by the author with colored pencils.

The power and trendiness of certain mystical imagery cannot be discounted as influences on the popularity of astrology. Clothing stores such as Urban Outfitters, which are marketed towards millennials, have no qualms on commodifying third eyes, zodiac symbols, and even crosses. In an ironic turn, what millennials have chosen to seek as an outlet from stress has been twisted to be commodified and sold to them by the very system that led them to seek the outlet. However, to discount the interest in astrology by today's younger generation as merely a fad fueled by a desire to be trendy discredits the many factors of using astrology as a coping mechanism. On the surface level, millennials seeking answers through a subject that has never been scientifically proven may be seen as nothing but strange and nonsensical for an incredibly technologically advanced society. However, it is important to acknowledge and analyze the coping methods of this generation, whether or not they are seen as proven forms of coping. The clothing stores and marketing groups have already taken note of this trend; perhaps it is important for families of millennials and psychologists to note it as well. This generation is at a high risk of depression and anxiety (Cain, 2018), and to see what forms of release they are seeking is helpful for understanding and healing. Apart from this grim perspective, it is interesting, and one may say exciting, to see in the modern world that "magic" is something that mankind still seeks and puts faith into despite how irrational it may seem. Furthermore, to see astrology existing in modern culture is, like organized religion, a testament to mankind's unending quest to seek higher meaning.

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Molecular Self-Organization of Three-Component Lipid Membranes

Austin Osby

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Molecular Self-Organization of Three-Component Lipid Membranes

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ABSTRACT By constructing a Landau-like energy functional, we investigate the molecular organization of a three-component mixture in cell membranes. In the strongly interacting limit, we model the interaction between molecules using pseudospin variables and convert them into non-interacting variables using a mean-field theory. Next, we construct the two-order parameter Landau-type energy functional through the Helmholtz free energy. By analyzing the Landau free energy, we map out the phase diagram focusing on homogeneous and various phase separated states on the cell membrane.

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INTRODUCTION

Self-organization of matter due to the collective behavior of constituent elements is a thermodynamic process that can be seen in variety of dynamical systems (Glansdorf & Prigogine, 1971), including biological systems (Camazine et al., 2013). The cell membrane is one of the classic examples of biological systems that show self-assembly of molecules. The cell, which is the fundamental building block of all living matter, consists of cytoplasm enclosed within a membrane where the cell membrane is composed of lipids and protein molecules. The cell membrane controls the vital role of providing a barrier of separation from the external environment, as well as the unique ability to selectively allow permeability of molecules to and from the cell through active and passive transport. In addition, the cell membrane allows for the flow of information between cellular contents and the external environment. In order to support these cellular functions, the cell membrane must be mechanically stable yet malleable enough to allow cell growth, cell division, and shape change for change dynamics. Most of the lipids in cell membranes share the same basic molecular structure by self-assembling into certain structures. It is the purpose of this work to study the molecular structure of cell membranes for a three-component mixture. As the motivation is to study the possible molecular arrangements in the cell, bi-layer formation or lipid raft formation is not considered due to the polar head group within lipids.

In a multi-component molecular system, the chemical interactions between different species are responsible for the self-organization of the molecules (Marrink, Risselada, & Mark, 2005; Shi & Voth, 2005; Muller, Katsov, & Schick, 2006; Deserno, 2009; Elson et al., 2010). At higher temperatures, the multi components within the system tend to form a homogeneous phase due to the entropy domination. However, at lower temperatures, the homogenous mixed phase is no longer thermodynamically stable and the different species tend to separate into domains at a certain critical temperature. The critical temperature and the number of fully or partially separated domains depend on the interaction between species. It is believed that the raft formation is due to the inhomogeneous distribution of lipids resulting from the phase separation of saturated lipids, unsaturated lipids, and cholesterol (Silvius, 2003; Radhakrishnan & McConnell, 2005; Veatch & Keller, 2005). Theoretically, the phase separation has been extensively studied for binary mixtures on cell membranes (Jrgensen et al., 1993; Sugar, Biltonen, & Mitchard, 1994; Komura et al., 2004; Hac et al., 2005; Banerjee & Saha, 2006; Elliott et al., 2006; Garca-Sez & Schwille, 2009; Almeida, 2011; Ehrig, Petrov, & Schwille, 2011; Kiselev et al., 2011; Camley & Brown, 2014; Pablo Gonzlez de Prado Salas et al., 2015; Pantelopulos et al., 2017); however, ternary systems have not been studied as extensively (Tumaneng et al.,2010). The lipid organization in a ternary mixture, such as saturated lipids, unsaturated lipids,

and cholesterol on cell membranes is studied using a thermodynamical approach. The strong interaction limit where the kinetic energy of the molecules can be neglected is considered relative to the interaction energies. As a result, the molecules tend to repel each other to minimize the interaction energies.

For this case, the occupation of molecules at a given point in space can be represented by a pseudospin. Thus, the phase separation or the coexistence of the different molecules due to the competition between ground state energy of pseudospins and entropy is determined by the collective behavior of the molecules. By analyzing the Helmholtz free energy and then deriving a Landau type energy functional, the phase diagram is constructed in temperature-interaction parameter space. The phase separation and the co-existence of molecules strongly depend on the temperature and the interaction between molecules. The detailed phase diagram in the interaction-temperature parameter space is derived.

The paper is organized as follows: Section II introduces an effective model and discusses its relevance to the cell membranes; Section III constructs the Landau energy functional through Helmholtz free energy using a mean-field theory; Section IV provides the phase diagrams with detailed results; and finally, Section V draws conclusions with a short discussion.

THE MODEL

We assume that each of the three components of the mixture can sit on a discrete lattice and interact with each other. As shown in Figure 1 below, the saturated lipids (A) and the unsaturated lipids (B) are sitting on a two-dimensional triangular grid while the cholesterol molecule (C) is sitting at sites on a complementary hexagonal lattice. Notice that the hexagonal lattice points are located at the centers of each triangle within the triangular lattice. Assuming only the nearest-neighbor interactions, we model the interaction between molecular components using an Ising type model. In this approach, we assume that the cell is large enough to have many lattice sites. Thus, physical quantities can be calculated averaging over many cells. We define two variables $\sigma i = \pm 1$, denoting the occupation of molecule A or B at site i on the triangular lattice and $s\alpha = 1$ or $s\alpha = 0$, denoting whether or not the hexagonal lattice site α is occupied by the molecule C. Then, the energy function or the Hamiltonian for these interacting molecules on the two-dimensional lattice grids is written in a generalized Ising model form. The fictitious lattice points for the molecular position on a cell is introduced to track the molecular positions in our mathematical calculations.

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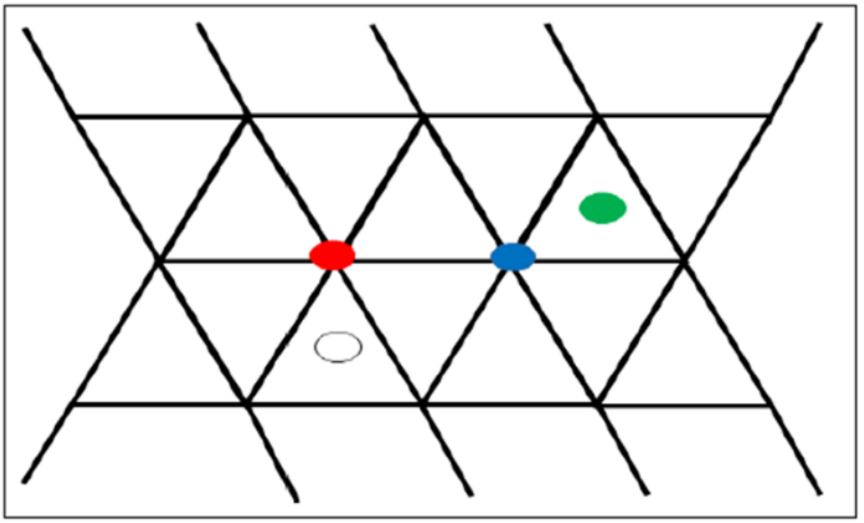

Figure 1: Occupation of A-molecule and B-molecule at corners of a triangular lattice

If a given site i at a triangular lattice site is occupied by an A-molecule (blue), we assign $\sigma_i = +1$, and if a given site j at a triangular lattice is occupied by the B-molecule (red), we assign $\sigma_j = -1$. All sites on the triangular lattice are occupied by either an A-molecule or a B-molecule. Notice that the centers of the triangular lattice can be connected to form a hexagonal lattice. If a center of the triangular lattice α (corner of a hexagonal) is occupied by a C-molecule (green), we assign $S_\alpha = +1$, and if the center of a triangular β is empty (empty circle), then we assign $S_\beta = 0$.

The model describing the occupation of molecules is thus given by *Equation 1*:

$$H = -J\sum_{\langle ij\rangle}\sigma_i\sigma_j - K\sum_{\langle j\alpha\rangle}\sigma_i\left(S_\alpha-\tfrac{1}{2}\right) - L\sum_{\langle\alpha\beta\rangle}\left(S_\alpha-\tfrac{1}{2}\right)\left(S_\beta-\tfrac{1}{2}\right) + M\sum_{\langle ij\alpha\beta\rangle}(\sigma_i\sigma_j)\left(S_\alpha-\tfrac{1}{2}\right)\left(S_\beta-\tfrac{1}{2}\right)$$

where $\langle ij\rangle$ represents only the nearest neighbors on the triangular lattice and $\langle\alpha\beta\rangle$ represents only the nearest neighbors on the complimentary hexagonal lattice. In this model, all the possible interactions between the molecules on the cell are represented by the coupling between the variables σ and S. The coupling strengths are represented by the molecular dependent interaction constant J, K, L, and M. For example, the first term represents the A − B molecular interactions between the nearest neighbor sites i and j on the fictitious triangular lattice. The second terms represent the A − C, A - empty, B − C, and B - empty molecular interactions between A and B molecules at site i on a triangular lattice, with C-molecules and empty site α on a fictitious hexagonal lattice. Similarly, the third represents the interaction between molecules on the hexagonal lattice. Finally, the

fourth term represents the interaction between molecules at four neighboring sites, with sites *i* and *j* being on the triangular lattice and sites α and β being on the hexagonal lattice. Here we assume that the interaction between molecules that are not neighboring are negligible compared to interactions with nearest neighbors.

THE LANDUA ENERGY FUNCTIONAL

The model Hamiltonian represented by *Eq. 1* describes the interacting molecules, thus it is unable to be solved exactly. However, solutions can be obtained by converting it into an effective non-interacting model. In order to convert the interactive Hamiltonian in *Eq.1* into an effective non-interacting Hamiltonian, we introduce two order parameters:

$$\phi = \sum_i \langle \sigma_i \rangle \equiv \frac{N_A - N_B}{N_A - N_B} \quad \text{and} \quad \Delta = \sum_\alpha \langle s_\alpha \rangle \equiv \frac{N_C}{N_C + N_E}$$

Here N_X, with X = A, B, C, E represents the total number of A, B, C molecules and empty sites on the cell membrane, respectively. These order parameters are defined as the quantum and statistical average values of the variables, σ and *s*. While non-zero values of ϕ represent the A – B phase separation, non-zero values of Δ - 1/2 represent the phase separation of C molecules and empty sites. By replacing the interaction variables with these order parameters, the internal energy $E = \langle H \rangle$ of the system can be written as:

$$E = -Jz\phi^2 - Kz\phi\left(\Delta - \frac{1}{2}\right) - Lz\left(\Delta - \frac{1}{2}\right)^2 - Mz\phi^2\left(\Delta - \frac{1}{2}\right)^2$$

where $z = 6$ and is the number of nearest neighbors.

The entropy of the system $S = -k_B \ln[G_{ab}G_{cb}]$ is then evaluated using the following:

$$G_{ab} = \frac{N_{tt}!}{N_A!N_B!}$$

$$G_{ce} = \frac{N_{th}!}{N_C!N_E!}$$

where G_{ab} and G_{ce} represent all the possible arrangements of molecules and empty sites on triangular and hexagonal lattices. The entropy is then evaluated to be:

$$S = -\frac{1-\phi}{2}\ln\left[\frac{1-\phi}{2}\right] - \frac{1+\phi}{2}\ln\left[\frac{1+\phi}{2}\right] - \Delta\ln\Delta(1-\Delta)\ln[1-\Delta]$$

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The entropy in thermal units $k_B T$ is plotted in Figure 2 below, where T is the temperature in Kelvins and k_b is the Boltzmann constant. Notice the entropy has a maximum at $\phi = 0$ and $\Delta = 0.5$. These are entropy dominated high-temperature values of order parameters. In the following, we expand the Helmholtz free energy ($F = E - TS$) around these high temperature values of order parameters up to the fourth order to obtain the Landau energy functional. The Landau energy functional is the order by order expansion of the Helmholtz free energy up to the fourth order in order parameters. Defining a new scaled order parameter $\alpha = \Delta - 1/2$, the Landau energy functional can be written as:

$$\frac{F}{k_B T} = \frac{1}{2} R_1 \phi^2 + \frac{1}{2} R_2 \alpha^2 + \frac{1}{4} Q_1 \phi^4 + \frac{1}{4} Q_2 \alpha^4 \frac{1}{2} P \phi^2 \alpha^2$$

where we introduced five new dimensionless parameters:

$$R_1 = 1 - \frac{2Jz}{k_B T}$$

$$R_2 = 1 - \frac{2Lz}{k_B T}$$

$$Q_1 = \frac{1}{3}$$

$$Q_2 = \frac{16}{3}$$

$$P = \frac{2Mz}{k_B T}$$

all dependent on the interaction parameters and temperature. The molecular organization on the cell membrane is then determined by the equilibrium values of order parameters ϕ and

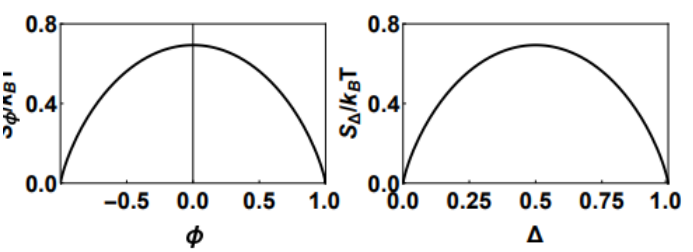

Figure 2
The dimensionless entropy $S/k_B T = S_\phi/k_B T + S_\Delta/K_B T$ as a function of order parameters ϕ and Δ. Notice that the entropies maximize at $\phi = 0$ and $\Delta = 0.5$.

α. Notice that α, which is related to the order parameter Δ, is introduced for convenience.

RESULTS

The equilibrium values of the order parameters depend on the interaction parameters and the temperature. For a given set of parameters, the molecules A−B are phase separated on the cell when the order parameter $\phi \neq 0$. In other words, when $\phi \neq 0$, the molecules A and B are mixed on the triangular lattice. Similarly, when the order parameter $\alpha = 0$ ($\Delta = 1/2$), the C molecules and the empty sites are mixed on the hexagonal lattice. As a result, the homogeneous phase is determined by the simultaneous conditions $\phi = 0$ and $\alpha = 0$ for a given set of interaction parameters and temperatures. If these simultaneous conditions are not met, then we have three different types of inhomogeneous phases depending on the values of ϕ and α. By minimizing the Landau energy functional with respect to the order parameters, we can construct the phase diagram of the system in interaction-temperature parameter space. By taking the derivative of the energy functional with respect to ϕ and α and then equating them to zero for minima, we analytically solve the minimization equations for equilibrium values for order parameters using three scaled parameters:

$$X_1 = R_1 / \sqrt{Q_1}$$

$$X_2 = R_2 / \sqrt{Q_2}$$

$$\lambda = P / \sqrt{Q_1 Q_2}$$

Notice that during our functional derivatives, the five temperature dependent dimensionless parameters, R1, R2, Q1, Q2, and P are replaced in the expense of only three temperature dependent dimensionless parameters, for mathematical simplicity. The results are summarized in the phase diagrams shown in Figures 3 and 4.

For both X1 > 0 and X2 > 0, we find equilibrium values of the order parameters $\alpha = \phi = 0$. These values of order parameters represent the mixed phase or the homogeneous phase of the cell membrane where all molecules A, B, C, and empty sites on fictitious hexagonal lattice are mixed together. In the phase diagrams shown in Figures 3 and 4. This phase is shown in blue in our reduced parameter space. For both X1 < 0 and X2 < 0, or when one of them is negative, we find completely phase separation or partially phase separation of phases. These depend on the interaction and temperature dependent parameters X1, X2, and λ. As examples, we construct phase diagrams for two representative values of the parameter λ = +0.5 and λ = +0.5 in Figures 3 and 4, respectively. The green region where X1 < 0 represents the molecular A − B phase separated phase with mixed C

and empty sites, where the order parameters $\phi \neq 0$ and $\alpha = 0$. On the other hand, the red region represents the C molecules and empty sites separated phase with mixed A − B molecular phase, where $\phi \neq 0$ and $\alpha = \phi$. The white region represents the phase separation where the molecules A and B separated, but coexist with either the empty sites or C molecules. Notice that the phase diagram is very sensitive to the parameter λ. When $\lambda = 0$, the phase diagram is symmetric in X1 − X2 parameter space, where the four phases exist in four quadrants symmetrically. On the other hand, when $\lambda = 1$, the green and red region merge at (X1, X2) = (−1.0, −1.0) while the white region disappears completely. Otherwise, the qualitative features of the phase diagram for other values of λ remain the same with the homogeneous phase in the first quadrant in X1 − X2 parameter space and sharing the other three phases in the remaining region in the phase diagram.

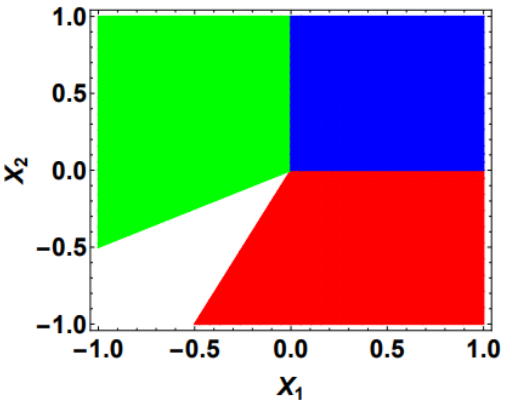

Figure 3
The phase diagram of the three-component mixture at $\lambda = +0.5$. The blue region represents the homogeneous mixture, where all three components co-exist in the same region of space. While the red region represents the C-molecule-empty mixed phase, the green region represents the molecular A-B mixed phase. In the red region, A and B molecules are separated. The green region, C-molecules and empty sites are separated. The white region represents the completely phase separated state. See the text for details.

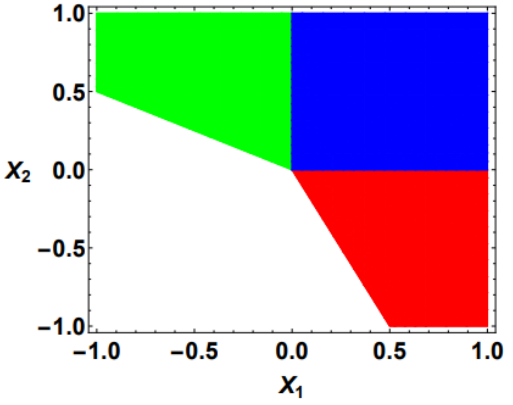

Figure 4
The phase diagram of the three-component mixture at $\lambda = -0.5$. The color code is the same as that of FIG .3.

DISCUSSION AND CONCLUSIONS

In this work, we used a thermodynamical approach to study the self-organization of a three-component molecular mixture on a two-dimensional membrane. By treating molecular interactions between localized molecules as spin variables we study the formation of the homogeneous phases and various phase separated states. We argued that the different phases emerge due to the com-petition between entropy and the energy originated from the collective behavior of molecules. We constructed a detailed phase diagram by introducing two order parameters through a mean field theory to specify the different composition of the mixture. Our phase diagram was deduced by minimizing the Landau-type energy functional derived from the Helmholtz free energy. We find that the rich phase diagram is very sensitive to the microscopic interaction parameters between molecules and the temperature.

In this work, we neglected the structure of the molecules thus enabling our ability to model the cell membrane as a two-dimensional surface. Although, our qualitative phase diagram is accurate for a structure-less three-component mixture, the molecular structure and the orientation must be included for more realistic mem-branes. These can be included, for example, by assuming that phospholipids are rod-like molecules which maintain their conformation through dipolar- dipolar interactions. This dipolar interaction gives negative interaction energies for the parallel oriented rod like molecules on two different planes. Thus, the negative interaction forces two rod-like molecules to form bound states and these bound states are responsible for the formation of bi-layers.

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The Importance of Encompassing Medical History in Pre-Medicine

Vinaya-Ann Alapatt

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The Importance of Encompassing Medical History in Pre-Medicine

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ABSTRACT This essay presents an argument on the integration of medical humanities in pre-medical undergraduate curriculum. This project culminated from an assignment of the Drawing II course in the spring 2018 semester, which included a short paper on a research topic of interest, and a drawing.

Keywords: medical humanities, pre-medicine, undergraduates, drawing

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The Importance of Encompassing Medical History in Pre-Medicine

The world was known to me, or in other words taught to me, through distinctly categorized subjects and scheduled classes. History, biology, politics, and chemistry were separated by all means: teachers, textbooks, methods of teaching, methods of learning, resources, and so on. I visually imagined the concept of knowledge as a pile of large boxes with each box containing distinct sets of information based on the subject. Over the course of my educational life, I realized that in order to truly experience that pile and to truly see the world, I would have to let the boxes disintegrate and allow the mound to freely exist as a mesh of information. The course of the education I received from the university led me to pursue this learning style, known as the interdisciplinary approach towards learning. This interdisciplinary approach can teach students to view and assess the world through multiple lenses. Integrating medical history into the pre-medicine track can provide students with a comparative understanding on how medicine interplays with culture, politics, and socioeconomic structure of a time period, which can then better shape one's philosophical approach towards medicine.

Figure 1: Illustration composed by the author using pencil.

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Pre-medical students are constantly under pressure to delve deeper and wider into cell biology, human physiology, and molecular biology. In my observation, I have seen pre-med students get lost in their highly detailed and rigorous subjects of study. Getting lost in that vastness of information is not necessarily bad; certainly, one must have a proper understanding on the subject and prove their capacity to comprehend the information in order to get into a medical program. However, it is also important to occasionally take a step back and get a glimpse of the overall vastness in which medicine lies. After all, the vastness is a mesh, where every subject is interlaced and connected through affecting and influencing each other.

Medicinal knowledge has shown to influence and shape the politics of each era. Many ancient societies, whose core beliefs were surrounded by monarchy, myths, and mysticism, influenced the medicinal practices of those societies. For example, the diagnostic and treatment methods of these societies contained elements of religion and superstition. The roles and status of those physicians were quite different from what they are now. In many ancient cultures, physicians were considered the authorities of God and the guardians of health because they healed and saved the people.

Along with this social role, power dynamics came into play. The possession of such indirect powers over the ruling system aided the physicians to stimulate social developments. Such examples are also visible in modern day societies. The solutions and preventative tactics found through public health crises often serve as means by which public health policies get altered or formed. The influences of medical industries on politics and the interplay of power dynamics between them function hand in hand towards the forward movement of our humanity.

This illustrates how the ability to see the bigger picture is just as important as the ability to delve into the intricate details. Students often consider the latter difficult, but the former requires a whole different process of understanding. Students often underestimate the importance of knowing the bigger picture of medicine and it is understandable why this happens. The institutional system encourages systematic focus on each discipline in order to better learn the subject. Therefore, the other unrelated subjects, such as philosophy, ethics, and history might seem useless, distracting, boring, or even time-consuming for the medicine-oriented students.

This underestimation of the humanities in the pre-medicine curriculum is bothersome. Learning medical history is important for pre-medicine students because studying a subject under multiple lens and contexts can help one assess his/her mental framework and point of view. It can help one realize the significance of context-based interpretation of issues, and it can reduce discrepancies between physicians' interpretations and patients' understanding of an issue. Lastly, it can aid in reorienting one's philosophical approach towards medicine.

Analyzing an issue from multiple perspectives can help a person assess their standpoint on the issue and to challenge their mental framework. Technically, medical science is supposed to be just about diagnosis, treatment, and prevention of diseases; however, it is often difficult to disentangle the disease component from other components such as socioeconomic background, ethnicity, personal history, and language. Thus, it becomes necessary to utilize additional lenses to look at biomedical issues. According to Courvoisier and Wenger (2005), human sciences – among history, literature and philosophy – are supposed to complete the biomedical point of view by stimulating alternative ways of considering issues in medical practice. Learning the history and philosophy of medicine can help practitioners in dilemmas by distancing themselves from the strictness and specificity of their professional points of view. This can offer alternative medical approaches and solutions.

Distancing oneself from the specificity of one's field can also provide a greater understanding on how it relates to other subjects and concepts. In this case, exploring medicine from outside the realm of science can help students realize how the functions of culture, historical period, and availability of resources affect a population's understanding and interpretation of an experience. For a microscale example, when a patient exhibits non-compliancy, it is beneficial to assess the issue from a sociocultural, economical, and historical point of view. An African American patient, for example, could be non-compliant because they mistrust the medical community due to the history of syphilis study in the late 1900s. Through an economical lens, one might also find that a lack of insurance, an inability to cover the treatment costs, or government policies to be the reasons for non-compliancy. Analyzing large scale health policies in this way can serve as a macroscale example for this.

Learning medical history can provide a broad scale awareness of the various components at play. Courvoisier and Wenger (2005) suggest that one way to achieve this broad scale awareness is through the process of distancing. The authors underline the idea of distancing and explain that distancing reveals that a natural way to describe a situation does not exist and that a point of view, whether scientific or not, depends on context and culture. This is a significant concept to keep in mind if one wishes to understand and interact with a culturally or generationally dissimilar population. It is also important when establishing and implementing health policies in this modern world.

Understanding how the differences in the structure of medicine over the centuries drove the course of human development and how it can change over time can help shape one's philosophical approach towards medicine. This understanding can bestow a sense of humility and gratitude within the scientists and physicians in our medical community. It can train them to examine the issues under multiple lenses and provide them with a broader and deeper understanding of the professional standards to uphold and their

influences on society.

Dr. Cordell (1904), a professor of the history of medicine at John Hopkins University, addressed the negligence of medical history in medical curriculum in his article. He questioned, "where is our boasted intelligence and superiority; that we do not perceive the danger and folly of such a course; folly in that we deprive our young graduates of the accumulated wisdom and experiences of all ages; danger in that we turn them loose without salutary checks and restraints that such studies afford?" (p. 273 Cordell also quoted Macaulay: "No man who is correctly informed as to the past will be disposed to take a morose and desponding view of the present" (p. 273). Dr. Cordell advocates on the importance of the study of the history of medicine as a course subject for graduate school curriculum, but it should also be considered in undergraduate pre-medical curriculum.

Like many people, I never bothered to learn about the history of medicine. I believed that science prior to the fourteenth century is all about myths and animism, and silly to compare it to what the twenty-first century can offer today. It was the book written by Eadie and Bladin (2001) A Disease Once Sacred that changed my perspective on the importance of medical history. The book contained information about the ancient and medieval manifestations of epilepsy, its supernatural and biological interpretations, and the remedies that ancient and medieval people used. This book introduced me to Hippocrates, Galen, Avicenna, and Razis, which prompted me to check out dozens of books written by them and about them. During my medical history explorations, I learned that medicine is not just about medicine; but about religion, anthropology, politics, economics, psychology, and mathematics, too. According to John Green (1968), "Human instinct, fear, hope, faith as well as great political and social events of the day, influence medical thought" (p. 3). Indeed, new ideas and discoveries in medicine interplay with important social legislations. Dr. Green (1968) says, "the history of human beings is inseparable from the history of ideas and facts" (p. 3). Medicinal knowledge connects people across cultures and across centuries.

Exploring the history of medicine made me realize that to understand medicine is to understand the differences in drug choices and the socioeconomic factors, how the medical system changes and that it will continue to change overtime, as well as the rights of the people and the ethics of care. Additionally, the history of medicine helps to understand the intergenerational perspectives and intercultural aspects of medicine, and to accept that there are many paths to conducting the right form of medicine. To understand medicine is to feel humility about life and gratitude for all the ways history equips us for a better future. Therefore, the integration of medical history in pre-medicine and the interdisciplinary approach towards medicine can be highly beneficial towards the betterment of this society.

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The Secret Garden and Anne of Green Gables: Nature versus Nurture and Childhood Escapism

Hannah Bertzfield

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The Secret Garden and Anne of Green Gables: Nature versus Nurture and Childhood Escapism

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ABSTRACT This literary analysis focuses on the protagonists of Frances Hodgson Burnett's *The Secret Garden* and Lucy Maud Montgomery's *Anne of Green Gables* to examine the correlation between a child's nature, the presence of nurture within their immediate developmental environment, and the resulting tendency to use escapism as a coping mechanism. Similar to a mild form of dissociation, escapism is a means by which the adolescent consciousness protects itself against negative external stimuli that may have damaging effects on the child's psychological state. This is especially true when the child is subjected to severe trauma or prolonged, repetitive patterns of abuse or neglect. Regardless of the environment or the child's socioeconomic position, nurturing is a force which counteracts the effects of negative stimuli and diminishes the subconscious need to escape. However, when nurture is absent, the likelihood of a child to utilize escapism as a means of coping with their environment is wholly contingent upon the child's nature.

Keywords: nature, nurture, escapism, dissociation, childhood

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INTRODUCTION

Through their depictions of what on the surface appears to be the simple pleasures of childhood play and interaction with their peers, Frances Hodgson Burnett's *The Secret Garden* and Lucy Maud Montgomery's *Anne of Green Gables* exhibit a correlation between nature versus nurture and childhood escapism. Both Mary Lennox and Anne Shirley are orphans displaced from the environments in which they were raised, but both have been acclimated to two very different modes of existence. One's understanding of her place in society is the utter inverse of the other's. Mary, born to relative luxury and a position of societal privilege, has no concept of poverty or subordination. Anne was born to parents "as poor as church mice" and has carried the damning stigma of orphan-hood since her infancy, depending upon the begrudging charity of others to have her most basic physical needs met (Montgomery, 1987, p. 46). The girls' dispositions and personalities are absolute opposites. Where one sees no reason to form connections with others, the other craves intimate interpersonal relationships. However, in spite of these integral differences, Anne and Mary have their similarities as well: neither of them has ever been the recipient of nurturing in order to foster their development, and, therefore, both girls use escapism as a means to exercise some level of control over their circumstances.

DEFINITION OF NATURE, NURTURE, AND ESCAPISM

In order to appropriately analyze the manner in which nature and nurture act as the determinants of how escapism manifests itself in Mary and Anne, it must first be established how each of these terms are used here. For the purpose of this analysis, "nature" refers to the biological, genetic composition that lays the foundation of an individual's physical characteristics, inherent personality traits, and basic morality, as well as the way in which these develop a person's character when one is confronted by external factors. The environment in which a child is raised dictates what external factors will cause an effect to what extent, which structures the growth of the child's nature. But no two natures are identical. Two people will not react to the same environment or external stimuli in exactly the same ways. This is the basis of individuality.

The most determining factor in a child's development is whether there has been exposure to a nurturing presence. Mary experiences this with the garden at Misselthwaite Manor and Anne through the people she comes to know and love in Avonlea. According

to Maslow's Hierarchy of Needs, food, water, and physical protection are the basic necessities required to sustain life in its most elementary form (Prince & Howard, 2002). "Nurture" is the amalgamation of these vital needs, which works to ensure a safe, encouraging foundation that fosters constructive physical and psychological development. In this vein, it becomes apparent that nurturing, when acting upon a compatible and willing nature, may counteract some of the otherwise detrimental effects of an unstable or even dangerous environment, so long as the child's basic physiological needs are met. When these needs cannot be adequately met, however, and the child's environment is unstable, dangerous, and devoid of nurturing, the amendable subconscious will instinctively do what it must to balance the deficit, be it physical, mental, emotional, or an amalgamation of the three. In some cases, this results in dissociation.

According to Ana Gomez (2013), dissociative processes are common instruments utilized by the adolescent brain to cope with external stimuli that cause severe physical and psychological distress. Gomez (2013) explains:

> Exploring all forms of trauma—including physical, sexual, emotional, witnessing domestic violence, medical illnesses, exposure to war or natural disasters, and accidents—their chronicity, and the familial responses are integral to assessing how a child defended against such experiences and whether dissociative processes were employed. (p. 132)

Gomez (2013) further explains that dissociation, like many cognitive disorders, exists on a spectrum of severity. On one end is the non-fragmentary tendency for "daydreaming or zoning out, fantasy, or absorption" in an activity that dislocates the consciousness from the body's physical surroundings. This typically has no adverse effects on the child's overall psychological development (Gomez, 2013). On the other end of the spectrum, fissures form in the child's consciousness, and there is a formation of one or more "self-states" that surface to stabilize the mind and body's psychophysiological processes during turmoil or times of distress—more commonly, though not clinically, known as having split personalities (Gomez, 2013). The pole towards which a child gravitates is contingent upon the severity of the trauma or neglect experienced and their natural capacity to cope without the utilization of a coping mechanism (Gomez, 2013).

This being said, it is imperative to specify here that dissociation is not the lens through which Mary and Anne will be evaluated, but rather it is a cognitive disorder comparable to how "escapism" is defined and applied in this literary analysis. While there are many parallels between the two, particularly in regards to Anne, consciousness and intent are the key factors that differentiate escapism from a mild form of dissociation, both of which are clearly exhibited by the girls throughout their respective narratives.

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NATURE VERSUS NURTURE: MARY LENNOX

In the first chapter of *The Secret Garden*, Burnett (2000) introduces the reader to a "sickly, fretful, ugly" little girl whose outward appearance, as it is later described by other characters, seems to mirror the inherent traits that she has developed thus far in her young life (p. 3). The daughter of English parents living in India, Mary Lennox was born into a position of socioeconomic privilege by virtue of her father's unspecified position in the English government. Though few other specific details about her parents are given, aside from her mother's affinity for parties and socializing, their complete lack of involvement in their daughter's rearing is made clear. Burnett (2000) places particular emphasis on the mother's aversion to her daughter and the subsequent effects of failing to create a constructive developmental environment when she writes:

> She had not wanted a little girl at all, and when Mary was born she handed her over to the care of an Ayah, who was made to understand that if she wished to please the Mem Sahib she must keep the child out of sight as much as possible…[Mary] never remembered seeing familiarly anything but the dark faces of her Ayah and the other native servants, and as they always obeyed her and gave her her way in everything, because the Mem Sahib would be angry if she was disturbed by her crying, by the time she was six years old she was as tyrannical and selfish a little pig as ever lived. (pp. 3-4)

Much like Mrs. Craven's abandoned garden, Mary's natural inclinations were left to propagate unchecked for ten years. She was temperamental, selfish, and aggressive being by nature. More than once, Mary recalls her past verbal and physical mistreatment of her Ayah without remorse or fear of repercussions. Because of her parents' neglect, the native servants entrusted with her care were put in a position where they could do nothing else but see that she had all of her physical needs met, obey the whims of a spoiled child without question, and suffer her abuses for the sake of their own economic livelihoods.

With such intolerable qualities left uncurbed by any manner of discipline or redeeming traits, it is inevitable that the servants and her Ayah would want as little to do with Mary as possible. As a result, not only was her psychological development greatly hindered by a lack of discipline, but also by the deprivation of any form of nurturing as well. In *Disciplining Girls*, Joe Sanders (2011) postulates that affective discipline wields far more effective results than corporal punishment while also avoiding the negative psychological ramifications that normalizing domestic aggression and violence entail. In Sanders' (2011) work, "affective discipline" is achieved by means of moral persuasion through love, affection, and positive reinforcement—in essence, nurture. It is undeniable that Mary has never been subjected to it. Not only has this neglect left her with no concept

that negative actions result in unfavorable reactions, but there is also the even more harmful effect of not developing the social skills or sense of empathy necessary to form positive connections with others.

In the chapter entitled "Mistress Mary Quite Contrary," Burnett (2000) gives the reader the first real example of how Mary interacts with people to whom she has little reason to believe herself superior. Up until now, Mary has interacted only with people who were considered beneath her but who had no choice but to serve her. However, while the English clergyman Mr. Crawford and his family are poor, this was commonly the expectation of a missionary's family and would not have detracted from their social respectability in the heavily religious English society of the early twentieth century. Secondly, it may be safely assumed by the nature of the Crawford children's rowdy, teasing interactions with Mary that they were also of a socially advantaged European descent, which would eliminate any assumption of superiority based on ethnicity, which Mary had learned could be used over the Indian natives under her parents' employ. Yet, when acting as the beneficiary of their kindness, Mary shows no sense of understanding that the Crawford's provision was not owed to her. Instead, Burnett (2000) writes:

> Mary hated their untidy bungalow and was so disagreeable to them that after the first day or two nobody would play with her…They tried to be kind to her, but she only turned her face away when Mrs. Crawford attempted to kiss her, and held herself stiffly when Mr. Crawford patted her shoulder. (p. 9, 11)

Initially, this may seem like impudent behavior from an overindulged child; however, when taking Mary's nature and her limited experience into consideration, such responses to these unfamiliar encounters, particularly during a time when her life is in a state of uncertainty and upheaval (her parents have died and she's now an orphan), seem natural. Mary has never been familiarized with affection, so a display of it from a stranger would of course present itself as odd behavior that was foreign and beneath her. "Affective discipline" has no effect on Mary.

Nurture, however, is inclusive of other forms of discipline even that of simple intolerance for inappropriate behavior, and it is at Misselthwaite Manor that Mary first encounters it in Martha Sowerby, the scullery-maid. When Martha is open and cheery and talks to Mary as an equal, Mary is puzzled and indignant. Mary compares Martha's demeanor to the submissiveness of the Indian servants to which she was accustomed. When Mary considers the prospect of slapping Martha as she would have done to her Ayah, Mary acknowledges that, while Martha was a "good-natured looking creature…she had a sturdy way" about her that made Mary realize that the maid would likely slap her back (Burnett, 2000, p. 24-25). Here, Mary is forced by an instinctive suspicion of self-preservation to recognize, at least in some capacity, the humanity and autonomy of others.

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NATURE VERSUS NURTURE: ANNE SHIRLEY

Conversely, Anne Shirley not only recognizes the humanity of others right from the start but also is an active observer of everyone and everything with whom she comes into contact. When Montgomery (1987) introduces Anne to the reader in *Anne of Green Gables*, Anne is described as a skinny, red-haired, freckled girl with an expressive face, wearing an old hat and a dress far too small for her (p. 19). More conspicuously, however, Montgomery (1987) goes on to blatantly tell the reader that "no commonplace soul inhabited the body of this stray woman-child of whom shy Matthew Cuthbert was so ludicrously afraid" (p. 19). Not only is the term "woman-child" in this passage unusual on a vernacular level, but the use of it as a term to refer to an eleven-year-old girl seems to imply that this particular adolescent "soul" harbors more experience than would be expected (Montgomery, 1987, p. 19). Details about Anne's life later revealed through recollection and implication in subsequent books of the series appear to solidify this sentiment.

As previously alluded to, Anne was orphaned at only three months old and has never known the security of a stable environment. Spending the first eight years of her life with the Thomas's, Anne is then passed on to the Hammonds with whom she spends more than two years before being sent to an orphanage. In talking about her past, Anne mentions how tiring it was to look after the many children present between these two households, which may seem like an obvious responsibility for a girl that, in a nurturing household, might be considered the equivalent of an elder sister. Considering that Anne is only eleven years old when she comes to Green Gables, however, it becomes clear that she has actually been playing the role of nanny since she was approximately seven years old, if not younger. Still, this might be considered commonplace for being part of a large family, especially being an orphan taken in and expected to earn her keep. The reality of these circumstances becomes disconcerting, though, when Marilla Cuthbert later asks Anne if Mrs. Thomas and Mrs. Hammond were good to her. In answer, Montgomery (1987) writes:

> Her sensitive little face suddenly flushed scarlet and embarrassment sat on her brow. "Oh, they *meant* to be—I know they meant to be just as good and kind as possible. And when people mean to be good to you, you don't mind very much when they're not quite—always. They had a good deal to worry them, you know. …But I feel sure they meant to be good to me." (p. 48)

This response and the long silence that follows implies far more than what Montgomery (1987) reveals in the book. Implication, however, is a tool Montgomery uses often in her works to reveal with discretion unfavorable or delicate details that may have been deemed

inappropriate for children's literature in the conservative twentieth century. For example, in chapter four of *Anne of Avonlea*, Anne argues with Gilbert Blythe, Jane Andrews, and Mr. Harrison over the necessity of using corporal punishment to make their students behave (Montgomery, 1998, p. 27-29). While the latter three see its usefulness to varying degrees, Anne is adamant that it is wholly unnecessary—declaring that it is "a cruel, barbarous thing to whip a child…*any* child"—and swears that she will never use corporal punishment in her classroom (Montgomery, 1998, pp. 27-29). Her staunch insistence seems to suggest past personal experiences, and these implied experiences in turn seem to be an unconsciously learned behavior. When one of her students puts a mouse in her desk, Anne whips him in anger and is immediately ridden with an overwhelming sense of guilt (Montgomery, 1998, p. 97).

Another implication about her childhood is made much later in *Anne of Ingleside*, when her daughter, Diana, befriends a girl at school that tells exaggerated tales of woe to win sympathy (Montgomery, 1998, p. 245). Anne sees through the tales and warns Diana not to take everything the girl, Delilah, says to heart (Montgomery, 1998, 245). Diana is hurt and angered by Anne's lack of sympathy, and, in the throes of indignation, asks her mother if she has ever cried from hunger:

> "Often," said [Anne].
>
> Diana stared at her mother, all the wind taken out of the sails of her rhetorical question. "I was often very hungry before I came to Green Gables—at the orphanage…and before. I've never cared to talk of those days." (Montgomery, 1998, p. 245)

In this simple, honest response to her daughter's misguided antagonism, Anne reveals an abrupt, tangible sense of severity of the true circumstances of her childhood to which the reader has not yet been exposed throughout the series. Before Green Gables, Anne's circumstances had only grown more desolate, and yet it is not a sullen and withdrawn or angry and calloused creature that Montgomery introduces at Bright River Station, but a "flighty, fanciful little waif that speaks only of goodness and beauty in the world and of red hair, freckles, and shortcomings in herself" (1987, pp. 19-29). Anne has known nothing but poverty and neglect in her young life, but her faith in people's goodness is an unshakable force that gives her an unjustified and inextinguishable hope for a life with love and happiness interwoven with its difficulties.

BALANCING THE DEFICIT: SEEKING AND OBTAINING NURTURE THROUGH ESCAPISM

While any such hope or optimism about the goodness of people who "*meant* to be good to [her]" (emphasis added) (Montgomery, 1987, p. 48) seems like little more than

sheer ignorance and naivety, this outlook is the product of an alternate form of nurturing that Anne has actively sought and allowed to influence her psychological development. Literature and poetry are entities akin to gods in Anne's life throughout the series, and most especially during the times when she has no other form of emotional reinforcement. While projecting her imagination onto reality begins as a means by which Anne escapes her unstable physical environment, by the time she reaches Green Gables, the places and characters she has read about have become as real to her as consciousness will allow. The stories Anne cherishes become the lens through which she views reality and that she must consciously remove to see her world as it really is. However, as is often the case with any over utilized form of stimulus, it is often difficult for Anne to displace her escape-perspective completely, which results in a skewed perception of people and situations. For example, rather than recognizing Gilbert Blythe's teasing as nothing more than relatively harmless schoolboy bullying, Anne harbors an intense sense of victimization despite many apologies and displays of good intentions on his part over the course of several years (Montgomery, 1987, p. 114).

In comparison, Mary's escape from reality is a literal one, rather than figurative, but there is an almost supernatural element to the garden that is not present in Anne's "flights of fancy." While Martha, Dickon, and Mrs. Sowerby play an undeniable role in Mary's budding ability to form connections with other people, it is the garden and, by extension, nature itself that takes on the role of nurturer for the girl. From the very beginning, in spite of her hateful and selfish demeanor towards others, Mary exhibits an unconscious compulsion to nurture and cultivate life by making pretend flowerbeds (Burnett, 2000, p. 4, 10). This compulsion is counter-productively executed, however, when Mary fails to recognize that in creating her pretend gardens by plucking the blooms from living plants and thereby killing them, she is also in reality killing what she unconsciously wishes to nurture by acting so temperamental and selfishly (Burnett, 2000, p. 4, 10). When Mary is taken to Misselthwaite Manor, however, this desire compounds itself with an instinctive need to distance herself from the other inhabitants of the house—to escape.

Unlike Anne, Mary has never been a slave to her thoughts and emotions because they possessed none of the drastic fervor that is characteristic of Anne. Instead, Mary's need to escape to a place of solitude stems from a sudden shifting in her consciousness that she has never been faced with before. She is learning from Martha and Dickon that her old ways of imperiousness and abuse are not acceptable in this new social structure, a difficult fact to digest when she is accustomed to always having her own way and is devoid of any interpersonal relationships to which she might turn for reinforcement or guidance. Burnett (2000) illustrates the beginning of change in Mary's consciousness and disposition in chapter 12 when Mr. Craven kindly asks Mary what would make her most happy at Misselthwaite Manor, and she answers that her only desire is for "a bit of earth…[to] plant

seeds in—to make things grow—to see them come alive" (2000, p. 109). Here, the reader sees that the garden does not operate in terms of human interactions, and while Mary nurtures it back to health and bloom, the garden in turn instills in her a sense of nurturing in the form of internal complacency and fulfillment that she has never known before.

CONCLUSION AND CORRELATION

Despite the differences in their natures and the ways in which they utilize escapism as a means of controlling equally different environments, Anne Shirley and Mary Lennox both serve to exhibit the correlation between a child's nature and exposure to nurturing and their tendency towards childhood escapism. While Mary's basic physiological needs are met, the complete lack of nurturing needed to help mold and refine her natural inclinations causes her initial struggles to form bonds with others and exhibit basic human emotions of empathy and love. Anne, on the other hand, is a highly emotive and empathetic person by nature and is able to not only preserve this tenderness through years of poverty and struggle, but to also foster it and grow into an even better, more sympathetic person because of her experiences. The manner in which children will respond to any number of environments and circumstances is entirely contingent upon their nature and how they respond to external stimuli. Escapism, however, may present itself in all sorts of ways, and the extent to which children seeks to escape is dependent upon the severity of the circumstances that they are seeking in order to mentally and emotionally distance themselves.

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