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†Winner of the 2008 Wallace L. Daniel Award for Undergraduate Writing, presented by the Zeta of Texas chapter of Phi Beta Kappa. This prize is awarded annually to the best paper (exclusive of those written by staff members) in *The Pulse*'s 2007-2008 print and online publications, as judged by a Phi Beta Kappa panel. In addition to a $200 cash prize, the recipient is invited to give *The Pulse* Student Lecture on the subject of his or her research.

Cover art created by Maria Petrozzi.

# FOREWORD

Now in its fourth year, *The Pulse* has existed for as long as current undergraduates have been at Baylor. The growth in the quality, quantity, and profile of undergraduate research at Baylor during that time is evidenced by the steady rise of interest in our publication and by the impressive quality of student work we offer in this edition. This spring *The Pulse* received a record forty-eight submissions, yielding an acceptance rate of just over ten percent.

*The Pulse* exemplifies on several levels the message of our motto, *Scientia Crescat*. By publishing the university's best undergraduate research writing each year, we facilitate the growth of knowledge in the university community. By committing ourselves to high standards of critical and editorial performance, the diverse staff of the publication grows in our own knowledge of our disciplines, our colleagues' disciplines, and the skills of scholarly writing and publishing. By raising the profile of student scholarship at the undergraduate level, *The Pulse* provides incentives for and models of the kinds of exemplary academic practices that cause knowledge to flourish campus-wide.

Our papers this semester are, as always, drawn from a variety of departments and disciplines; unusually, however, they cohere around a sustained engagement with the legacy of the Enlightenment. A particular strength of this edition, therefore, is the visibility it brings to ways that questions of truth are contested and applied in our own university community. Gary Guadagnolo's paper shows how Russian higher education both responded to and shaped that nation's vexed embrace of the modern world. Matthew Newell's essay uncovers serious theological issues inherent in the scientific theories of the early modern scientist Isaac Newton. Martin Hechanova's study valorizes two eighteenth-century Spanish intellectuals who advocated for Enlightenment-based scientific progress in Spain. From an opposite point of view, Courtney Micksch's reading of T. S. Eliot's poetry excavates the poet's critique of Enlightenment-based ideas about science and progress. Kali Domoney's paper, which articulates the results of her laboratory research on cancer-fighting pharmaceuticals, is a contemporary instance of the ongoing application of the scientific revolution.

The disciplinary range of the papers is reflected in the composition of *The Pulse* staff, which is responsible for evaluating and editing the

papers, doing publicity, and managing the necessary technology, including professional-quality typesetting and artistic design. The all-volunteer staff donates its scarce time and abundant talents in service to the university through this publication; we cannot say enough in praise of their dedication, professionalism, and generous goodwill.

This edition is also available on our website, www.baylor.edu/pulse, with previous issues available in our archive. The fall 2007 edition, containing papers from the Political Science department, is the second in our series of online publications featuring a specific department or group of departments. The first such edition in the fall of 2006 presented papers in Great Texts, and next fall we will publish an online issue of *The Pulse* dedicated to student research in the physical sciences.

The staff of *The Pulse* is deeply grateful to our sponsoring unit, the Honors College, for its financial and logistical support of our operations. We are likewise indebted to Phi Beta Kappa, Zeta of Texas, for sponsoring the Wallace L. Daniel Award for Undergraduate Writing, presented to the top paper in *The Pulse*. The winner of this award is also invited to present the annual *Pulse* Student Lecture, generously hosted and sponsored by the Honors Residential College.

Martin Hechanova
President

Amanda Weppler
Chief Editor

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Faculty Sponsor

*Chemotherapy is one of the most common and effective forms of cancer treatment today. The purine nucleoside analog clofarabine is a newer chemotherapy agent used prior to hematopoietic transplant. Our research finds that the presence of Breast Cancer Resistance Protein reduces the accumulation of clofarabine, thus reducing its cytotoxic effect on cells.*

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# The Relationship Between Breast Cancer Resistance Protein and the Anticancer Drug Clofarabine

Kali Domoney

**Abstract**

Purine nucleoside analogs have been effectively used in chemotherapy cancer treatment; the analogs enter cells and cause cell death, which helps rid the body of cancer. However, their effectiveness is limited by factors controlling intracellular levels of the drug. Clofarabine is a nucleoside analog that has recently been used in leukemia chemotherapy, but some studies suggest tissue accumulation is limited by the factors that control the intracellular levels of the drug. We tested the hypothesis that the Breast Cancer Resistance Protein (BCRP/ABCG2) (ATP-binding cassette, ABC, transporter) can reduce the intracellular accumulation of clofarabine. This hypothesis suggests that BCRP is one of the factors that controls and limits the intracellular levels of clofarabine, limiting its effectiveness by allowing more cancerous cells to survive. We show that BCRP reduces the accumulation of clofarabine, and this reduction is specifically reversed by the selective BCRP inhibitor Fumitremorgin C (FTC). We also show that BCRP reduces the cytotoxicity of clofarabine; the cytotoxicity of clofarabine is the ability of the drug to cause cell death. We continue by showing that this reduction of cytotoxicity is diminished by FTC. Finally, we demonstrate that BCRP overexpression in myeloid leukemia enhances resistance to clofarabine. Our data demonstrates that BCRP's presence reduces accumulation of clofarabine and directly reduces cytotoxicity.[1]

**Introduction**

Cancer is a devastating and often fatal disease. However, successful measures against cancer are becoming more common as treatments become more effective. There are several methods used to treat cancer, including radiation, surgery, and chemotherapy. Chemotherapy is an aggressive treatment which utilizes several types of pharmacological drugs and is administered intravenously. The side effects of chemotherapy can be harsh and can include vomiting, decreased appetite, fatigue, and hair and nail loss. The drugs administered in chemotherapy vary based on several factors, including the type of cancer, the patient's drug history, and other details particular to the patient, such as age. Different chemotherapy drugs use different pathways to combat cancerous cells. Drugs like clofarabine enter cells through uptake carriers and induce cell death once inside the cell. This cell death, also known as apoptosis, is necessary to eradicate cancerous cells.

Chemotherapy agents have developed as trials and studies have provided new information about their pathway once inside the body and their effectiveness in combating cancer. One of the earliest chemotherapy drugs was nitrogen mustard, which was introduced in the 1940s (Gottesman, 2002). Since then, a sizeable array of anticancer drugs have been discovered and developed. In the 1960s, anthracyclines, a class of antibiotics used to treat cancer, were created (National Cancer Institute, n.d.). Treatment of acute myeloid leukemia (AML) with anthracyclines is still practiced today but has a poor overall outcome; AML patients experience a 50% chance of complete relapse, harsh side effects, and inadequate long term survival (Wang et al., 2007). As researchers and clinicians are hoping to find improved treatment for AML patients, several new drugs are being introduced. Nucleoside analogs are one of the most common types of anticancer drugs; this group of drugs functions by affecting nucleic acids (Slavik, 1975). Nucleic acids make up a cell's genetic information; therefore, altering a cell's nucleic acids alters its reproduction capabilities and causes apoptosis in nondividing cells (King et al, 2006). However, one nucleoside analog, 9-β-D-arabinofuranosyladenine (ara-A), commonly experiences deamination (the removal of a nitrogen containing group, which alters the composition of the molecule) by an enzyme called adenosine deaminase. The discovery of this deamination led to the development of a group of adenosine deaminase-resistant nucleoside analogs, a group that includes cladribine and fludarabine and later the derivative of cladribine, clofarabine (King et al., 2006). Once

inside the cell, these drugs cause apoptosis, limiting the spread of cancerous cells (King et al., 2006).

Our research focuses on the nucleoside analog clofarabine. The cytotoxic actions of clofarabine are intracellular, making it a requirement for clofarabine to enter the cell before it can be part of an effective treatment (King et al., 2006). There are three major tactics by which drugs enter cells: diffusion, transport, and endocytosis (Gottesman, 2002). Diffusion occurs when a difference in extracellular and intracellular concentrations of the drug cause the drug to seek maximum separation. When this separation is favorable, the drug enters the cell. Transport into the cell is either adenosine triphosphate (ATP, a form of energy) dependent or ATP-independent. Transport requires a protein which assists in the movement of the drug from the extracellular environment to the inside of the cell. Endocytosis occurs when a cell engulfs the drug, closing around it, which allows the drug to reside intracellularly. Nucleoside analogs, including clofarabine, enter the cell through transport by a transporter protein (Gottesman, 2002). Equilibrative nucleoside transporters (ENTs) and concentrative nucleoside transporters (CNTs) are structurally unrelated protein families, which are considered the mostly likely candidates for transport of clofarabine (King et al., 2006). Transporters for the nucleoside analogs include three affiliates of the ENT family (hENT1, 2, and 3) and three affiliates of the CNT family (hCNT 1, 2, and 3) (King et al., 2006). Clofarabine uptake seems to be most effective with hENT1 or hCNT3, although hENT2 and hCNT2 have also been shown to transport clofarabine (King et al., 2006).

The entry of clofarabine into the cell is necessary for the drug to have effect because its actions are intracellular; the ENT and CNT uptake carriers allow the imperative entry of clofarabine into the cell. However, Wright, Gati, and Paterson have demonstrated—through the use of an uptake inhibitor—that uptake is not the only factor contributing to cytotoxicity (Wright et al., 2000). In the present study, we wanted to test the effects of efflux—the transport of clofarabine out of the cell—on cell viability.

The ATP-binding cassette (ABC) family is a large group of ATP-dependent transporters and is thought to be a contributing factor to much of the resistance encountered in anticancer treatment (Gottesman, 2002). The discovery of ABC transporters opened a vault of research opportunities. Every organism has within its systems many members of the ABC family which are involved in a variety of actions

within cells (Gottesman, 2002). Some of the actions of these transporters are beneficial, such as transporting nutrients into and out of the cell (Gottesman, 2002). However, these proteins also transport substances such as pharmaceutical drugs out of cells, and there is a strong correlation between anticancer drug resistance and ABC protein expression within resistant cells (Gottesman, 2002).

The most studied ABC transporter is P-glycoprotein (Pgp/MDRI/ABCBI) (Ross, 2004). Pgp has many substrates, so it can alter the efficacy of a variety of drugs (Gottesman, 2002). Cells that express Pgp commonly experience increased viability. Therefore, as is often seen in myelodysplastic syndromes, a group of diseases in which the bone marrow does not make enough healthy blood cells, Pgp expression increases over time, leading to accumulated resistance (Ross, 2004) (National Cancer Institute, n.d.). Finally, there exists a correlation between poor outcome of acute myeloid leukemia and myelodysplastic syndrome and the existence of Pgp within patient cells (Ross, 2004).

The discovery of another ABC protein, known as the Breast Cancer Resistance Protein (BCRP, ABCG2), has stimulated research aimed at discovering its function in the cell. Because BCRP is an ABC transporter like Pgp, researchers wondered if BCRP is also correlated with anticancer drug resistance. Although its name may lead one to believe that this protein is found only in the breast, it has also been found in the placenta, intestine, and liver (Gottesman, 2002). It has been shown that BCRP can transport several different anticancer drugs (Ross, 2004) and can work independently of Pgp and Multi Resistance Protein 1 (MRP1) (Krishnamurthy and Schuetz, 2006). This information suggests the possibility of BCRP's influence on cancerous cells by increasing the cells' survival during treatment.

Our research studies the nucleoside purine analog and anticancer drug clofarabine. Using several experimental methods involving cancerous cells, we show that BCRP transports clofarabine out of the cell. Clofarabine must be intracellular to be effective and cause apoptosis. Therefore, when cells being treated with clofarabine contain BCRP, the intracellular levels of clofarabine are reduced and so is the drug's efficacy. If BCRP is found to transport clofarabine out of the cell and to reduce the intracellular levels of the drug, chemotherapy treatments may need to be altered to include a BCRP inhibitor to make treatments more effective.

## Materials and Methods

*Materials*

Materials used included Fumitremorgin C purchased from Alexis Biochemicals, San Diego, CA; CellTiter 96 Non-Radioactive Cell Proliferation Assay Kit purchased from Promega Corporation, Madison, WI; Bio-Rad Protein Assay purchased from Bio-Rad Laboratories, Hercules, CA; clofarabine purchased from Sigma-Aldrich Inc., Atlanta, GA; Primary Antibody for BCRP (BXP53) purchased from Alexis Biochemicals, San Diego, CA; Primary Antibody βActin, ECL™ Anti-Rat IgG horseradish peroxidase-linked whole antibody NA935V, and ECL™ Anti-Mouse IgG horseradish peroxidase-linked whole antibody NA931V, both purchased from Amersham Biosciences UK Limited Little Chalfont, Buckinghamshire, England (Takenaka et al, 2007).

*Cell Culture*

The cells used were from the human osteosarcoma cell line, Saos2. The cells were cultured in DMEM containing 10% FCS and 1x L-glutamine. The BCRP-overexpressing Saos2 cells (Saos2-BCRP) and the empty vector control cell line, Saos2 pcDNA3, were used (Takenaka et al., 2007). The cells were incubated at 37 degrees Celsius and 5% $CO_2$.

*Immunoblot Analysis*

The Bio-Rad Protein Assay was used to quantify protein concentration, and bovine serum albumin (BSA) was used as the standard. Protein was resolved on a 10% SDS-PAGE gel and transferred onto a Hybond nitrocellulose membrane (GE Healthcare, Pittsburgh, PA). The membrane was incubated with the primary antibody for two hours. The primary antibody used for BCRP was BXP53 (1=1,000), and for actin the primary antibody was against βActin (1=10,000). Following washes, the membrane was incubated in the appropriate secondary antibody for one hour following the manufacturer's instructions. Amersham Enhanced Chemiluminescence Detection System was used for detection of the probed protein.

*Cytotoxicity Assay*

Each well in the 96-well plates contained 10,000 cells in the presence of differing concentrations of clofarabine, as listed, for a final volume of 100μl per well. The plates were incubated at 37 degrees Celsius and 5% $CO_2$ for 6 hours with the clofarabine. The media was then

changed and the cells were incubated for another 66 hours at 37 degrees Celsius and 5% $CO_2$. The CellTiter 96 Nonradioactive Cell Proliferation assay was used by following the manufacturer's instruction to determine cell survival. The percentage of cell survival was determined by comparing the cells treated with clofarabine to untreated cells. Each plate included quadruplicate samples for each drug concentration of clofarabine. A cell survival of 50%, an $IC_{50,}$ was determined.

*Uptake Assay*

Cells were seeded at $1x10^6$ cells per well in a 6-well plate and incubated overnight in DMEM with 10% FBS. Cells were washed once with 1xHank's solution and exposed to [$^3$H]Clofarabine 10μM (100dpm/pmol) for up to 120 minutes. At selected time points, cells were washed with 1xPBS three times and lysed with 0.5M NaOH. Radioactivity was measured by scintillation counting. Uptake was corrected for protein content which was measured by Bio-Rad Protein assay (see materials).

**Results**

Over a period of 120 minutes, the uptake of clofarabine was measured in twenty-minute increments in both vector and BCRP transvected Saos2 cells.

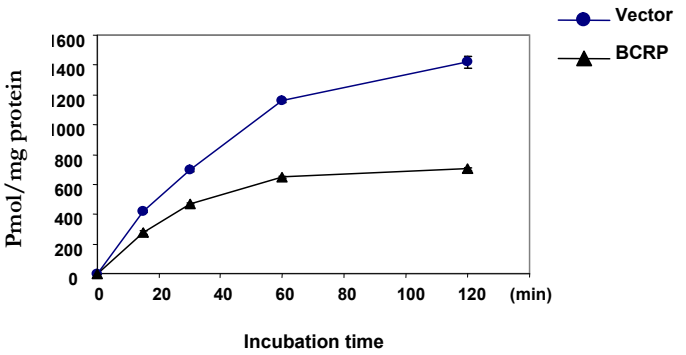


Figure 1- Clofarabine uptake assay using the Saos2 cell line (10uM)

The vector cells were identical to the BCRP transvected Saos2 cells except that they did not contain the added amounts of BCRP. (See Figure 1.)

Both varieties of Saos2 cells showed an increased accumulation of clofarabine over time, but accumulation in the vector Saos2 cells was consistently higher than the accumulation in the BCRP Saos2 cells.

To compare BCRP expression levels with clofarabine uptake we performed a western blot for BCRP and an uptake assay using the same cells (Saos2 vector and Saos2 BCRP) to make a comparison. (See Figure 2.) The western blot for BCRP used BXP53 for the primary antibody and the appropriate secondary antibody. The actin western blot uses actin, a protein present in all three types of cells, to serve as a standard for comparison with BCRP. The actin western blot used βactin for the primary antibody and the appropriate secondary antibody (see Materials and Methods).

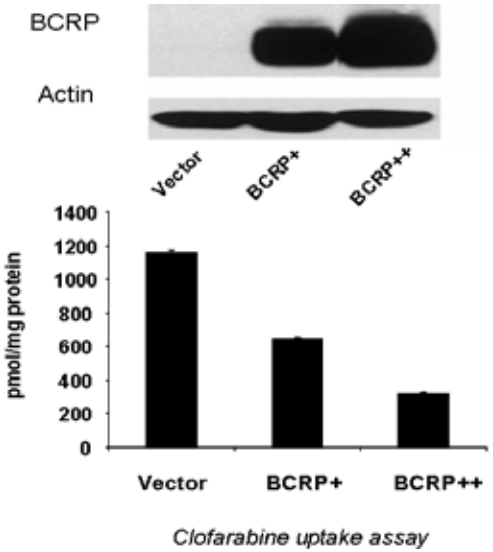


Figure 2-Western Blot for BCRP and Clofarabine Uptake Assay

The western blot for the vector cells is indistinguishable. The BCRP+ cells show a distinguishable amount of the BCRP protein, and

the BCRP++ cells show an even greater amount of the BCRP protein. This data negatively correlates with the clofarabine uptake assay in these cells. The vector Saos2 cells showed the greatest accumulation of clofarabine, followed by the BCRP+ Saos2 cells, and then the BCRP++ Saos2 cells.

To verify that the differences in clofarabine uptake by vector and BCRP Saos2 cells were due to BCRP and not another variable, we performed a clofarabine uptake assay with and without Fumitremorgin C (FTC), a BCRP inhibitor. (See Figure 3.)

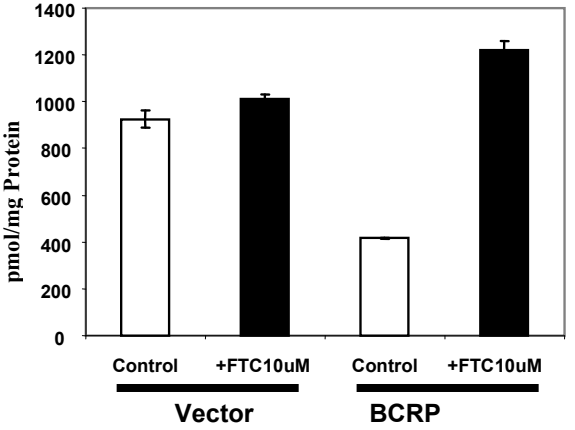


Figure 3- Clofarabine Uptake Assay Using Saos2 Cells and FTC, a BCRP inhibitor

When FTC is used, vector Saos2 cells show a slight increase in clofarabine uptake compared to uptake without the use of FTC. When FTC is used in BCRP Saos2 cells, a nearly 300% increase is seen in the amount of clofarabine taken into the cell.

To determine the effect of BCRP on clofarabine's cytotoxicity, we performed a cytotoxicity assay using differing concentrations of clofarabine as listed and measured cell viability at the end of the 72-hour incubation. Saos2 vector and Saos2 BCRP cells were utilized. (See Figure 4.) However, the BCRP cells showed an increased viability in all clofarabine concentrations tested except when 0μM of clofarabine was administered. The concentration of clofarabine at which 50% of the cells are

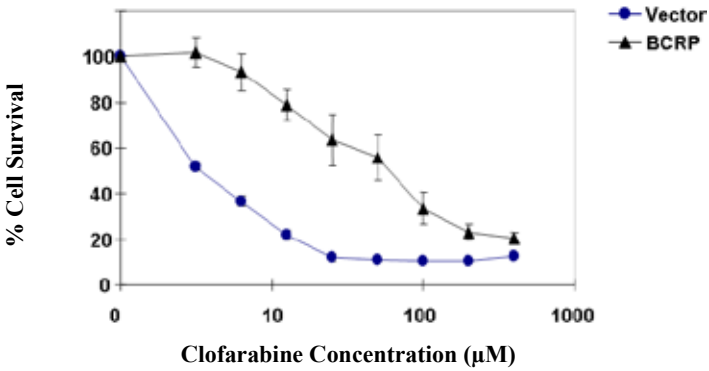


Figure 4- Cytotoxicity Assay Using Vector and BCRP Saos2 Cells

alive, or the $IC_{50,}$ for the vector cells was about 6.5µM of clofarabine and about 90µM of clofarabine for the BCRP cells.

Finally, we wanted to quantitatively see the effect of FTC, and therefore BCRP, on the cytotoxicity of clofarabine. We performed a cytotoxicity assay with Saos2 vector and BCRP cells both with and without FTC. (See Figure 5.)

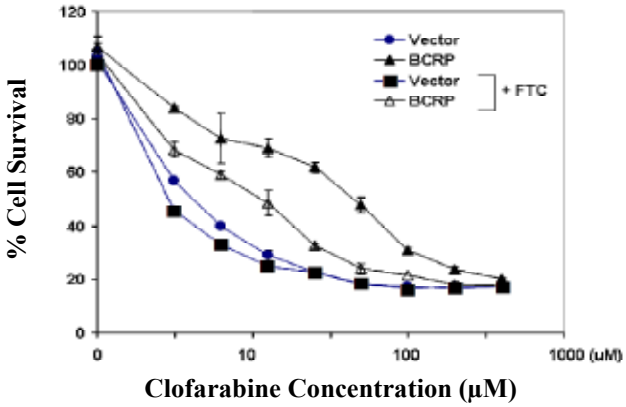


Figure 5- Cytotoxicity Assay Using Saos2 Vector and BCRP Cells Both With and Without FTC

In the cells void of FTC, there was a recurrent shape of the lines as seen in past cytotoxicity assays. Again, the BCRP cells experienced a greater cell viability compared to the vector cells. This was also true when FTC was used; however, the area between the vector and BCRP lines was reduced. The IC50 for the vector cells void of FTC is about 7μM of clofarabine, and the IC50 for the BCRP cells void of FTC is about 70 μM of clofarabine. The IC50 for the vector cells with FTC is about 5μM of clofarabine, and the IC50 for the BCRP cells with FTC is about 10μM of clofarabine.

**Discussion**

Our results support the hypothesis that BCRP can reduce the intracellular accumulation of clofarabine. In Figure 1, the BCRP cells show a consistently lower accumulation of the drug remaining inside the cell. According to the hypothesis, this occurred because when clofarabine entered the cell, it was bound to the BCRP and transported outside the cell membrane. Figure 2 shows a direct correlation between the amount of BCRP present and the uptake of clofarabine. The relationship defined in the information proposes that the greater the amount of BCRP present in the cell, the lesser the accumulation of clofarabine inside the cell.

Fumitremorgin C (FTC), a BCRP inhibitor, was used to detect the actual effect of BCRP itself on clofarabine uptake. FTC was used to ensure that the differences in the results between the BCRP transvected cells and the vector cells were due to the BCRP and not to another variable. This use of FTC establishes the extent of BCRP's influence. In the uptake assay in Figure 3, the vector cells show a slight increase in clofarabine uptake when used in conjunction with FTC. Although vector-transvected cells did not show expression of BCRP in the western blot, they possibly contain trace amounts of endogenous BCRP. A slight increase in clofarabine uptake when FTC was used with the vector cells was expected to account for the natural amount of BCRP present. There was a significant—approximately 300%—increase in clofarabine uptake when FTC was used with the BCRP expressing cells compared to the clofarabine uptake in BCRP cells deficient in FTC. This relationship portrays BCRP's impact on the reduction of clofarabine inside the cell.

We also studied the effect of BCRP efflux on cytotoxicity. In Figure 4, there is a considerable difference between cell survival in the vec-

tor and BCRP cells when clofarabine is administered. This data supports the hypothesis that BCRP transports clofarabine out of the cell, thus affecting cytotoxicity. When less clofarabine is present, the cell will be more likely to survive and avoid apoptosis.

FTC was again utilized to make certain that the differences in the cytotoxicity results between the vector and BCRP cells were due to BCRP. When a cytotoxicity assay comparing vector and BCRP cells was performed with FTC, the divergence between the vector and BCRP cells' cytotoxicity void of FTC was decreased by a substantial amount. However, if BCRP was the sole factor responsible for the difference in the cytotoxicities of the two types of cells, the FTC use would cause the curve for the vector and BCRP cell cytotoxicity to become identical by causing BCRP to lose its function. Because there is a sizeable change in the distance between the two curves, illustrating that the vector and BCRP cells' survival rates became much more similar with the FTC, one may presume that the BCRP transporter has a noteworthy impact on cytotoxicity and the transport of clofarabine. However, one should also presume that there may be another variable affecting clofarabine transport since the two curves for vector-transvected cells and BCRP expressing cells are not the same. One candidate for this difference includes differences in clofarabine uptake by solute carriers such as hENT1, hENT2, hCNT2, and hCNT3.

Once inside the cell, clofarabine undergoes phosphorylation—the addition of a phosphate group—by the enzyme deoxycytidine kinase (dCK), and it is not yet clear if clofarabine requires phosphorylation to be recognized as a substrate of BCRP. The phosphorylation changes the structure of clofarabine, and further experiments will be necessary to determine which form of clofarabine—phosphorylated or unphosphorylated—is transported by BCRP. This interaction with dCK is another possible candidate for the difference seen in figure 5. Future studies on BCRP and clofarabine interaction should include cytotoxicity studies on additional types of leukemia cell lines that overexpress BCRP, determining the form of clofarabine transported by BCRP, determining the role of uptake carriers, and performing in vivo studies using mice to do a survival study and to measure the accumulation of clofarabine and its metabolites in tissues.

Additionally, future study of BCRP will also impact leukemia treatment. The presence of BCRP has been detected in close to 30% of all AML cases (Ross, 2004). The majority of pediatric patients who

attain complete remission from acute myeloid leukemia (AML) relapse with resistant disease (Ross, 2004). BCRP expression is increased in this relapsed disease—called refractory AML—compared to its expression at diagnosis (Ross, 2004). This finding has caused many researchers to wonder if BCRP is involved in this resistance.

If BCRP is proven to be involved in anticancer drug resistance, future studies should include a BCRP inhibitor, such as FTC, in chemotherapy treatments when clofarabine is administered. With the use of the BCRP inhibitor, greater amounts of clofarabine will remain inside the cell and will cause decreased cell viability, suspending cancer growth. Overall, the effectiveness of clofarabine in chemotherapy treatment will greatly increase if BCRP activity is prohibited.

**Conclusions**

According to the data our present research has provided, it is likely that clofarabine is a substrate for BCRP. Our results support the idea that BCRP is a detriment to clofarabine's leukemia treatment because it is responsible in part for cellular resistance. When BCRP transports clofarabine out of the cancerous cell, the cell will not experience apoptosis and will continue to grow and divide, which is harmful to the patient as the cancer will continue to grow. If our hypothesis does indeed prove to be true, more study will be needed to possibly involve BCRP inhibitors in treatment.

As cancer research in the pharmaceutical sciences continues to advance, chemotherapy treatments will become more successful. In the case of clofarabine, research discoveries will improve its involvement in pre-hematapoeitic transplant use for relapsed and refractory leukemias.

## NOTES

[1] I wish to thank the Pediatric Oncology Education (POE) program and POE director, Dr. Suzanne Gronemeyer, Ph.D., for allowing me to spend the summer at St. Jude Children's Research Hospital. I also wish to thank the Pharmaceutical Sciences Department at St. Jude Children's Research Hospital for allowing me to be involved in this research. Finally, I wish to thank Dr. John Schuetz, Ph.D., for allowing me to work in his lab and Dr. Kazumasa Takenaka, M.D. Ph.D., and Dr. Isabelle Letourneau, Ph.D., for their help and guidance in the lab.

[2] Western blotting, also known as immunoblot analysis, is a technique used to

identify proteins. Extracted proteins are transferred onto a membrane and incubated with the primary and secondary antibody. After appropriate incubation, the protein is probed and developed on a film which can be used for identification.

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*In analyzing how higher education has historically responded to and facilitated social change in Russia, the relevance of key leaders emerges throughout the three eras of modern Russian history: tsarist, Soviet, and post-Soviet. Each of these periods represents certain challenges for the creation of civil society, but the autonomy and diversity of the post-Soviet era presents the greatest hope for higher education in Russia today.*

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# The Leadership Challenge in Russian Higher Education

Gary Guadagnolo

Universities, which seek to educate and train successive generations of scholars, scientists, and leaders in every field of study, provide an essential component in the creation of a thriving civil society. Undoubtedly, many of the citizens educated through the university system must also contribute to the state apparatus in order for the government to operate effectively and successfully. Particularly within societies ruled by powerful and even authoritarian governments, however, the university environment can foster voices of dissent cultivated by the enlightened and freethinking perspective that educated environments facilitate. Therefore, by encouraging the pursuit of higher education, such governments paradoxically provide the methods and means for the most intelligent minds in the country to critique the established order.

This double-edged nature of higher education manifests itself throughout the Russian tradition, as each regime has attempted to balance the need for supporting learning environments while preventing uncontrolled radicalism that could potentially damage the stability of the state. Universities in Russia have repeatedly confronted the issue of whether unquestioning support and devotion should be offered to the state in the interests of peace and prosperity, or if students should be encouraged to think openly and challenge the process, even if that results in dissenting or revolutionary ideas.

In analyzing how higher education in Russia has historically responded to and facilitated societal change, the relevance of key leaders emerges throughout the three eras of modern Russian history: tsarist,

Soviet, and post-Soviet. During the late-tsarist era, Count Dmitrii Tolstoi profoundly impacted education in Russia through his role as the Minister of Public Education. In particular, Tolstoi's harsh and reactionary response to dissent within universities merits close examination for the way it pushed the country towards revolution; Tolstoi's unwillingness to acknowledge the necessity of change left students and faculty with no other choice. Over a century later, Mikhail Gorbachev also encountered the problems of a changing society as the Soviet era drew to a close. The reforms Gorbachev supported both as the chair of the Politburo's commission for educational reform and then as the General Secretary of the Communist Party indicated his own understanding of the need for change, but even Gorbachev could not overcome the entrenched bureaucracy of the Soviet system. Finally, in regard to post-Soviet higher education in Russia, the success of administrators and clergy working at local levels to transform universities contrasts with the ineffectiveness of politically powerful leaders such as Tolstoi and Gorbachev. In exploring opportunities for civil society to develop most fully in the post-Soviet context, such decentralized leadership holds the greatest promise for the success of Russian higher education in the twenty-first century.

**The Committed Bureaucrat: Dmitrii Tolstoi**

Count Dmitrii Andreevich Tolstoi epitomized the conservative bureaucrat who desired to preserve the power of the tsarist regime in nineteenth-century Russia. His blind devotion to administrative structure and security, combined with his inability to respond to legitimate calls for change, relegated Tolstoi's image to that of an outdated state servant exhausted from his attempts to prevent the liberalization of universities. Partially because of the bureaucracy of the tsarist system, but more likely as a result of his ideological stubbornness on key issues of reform, Tolstoi failed in facilitating an academic environment that could benefit either the state or the students.

Born in Moscow in 1823, Tolstoi spent his entire life trying to maintain what he considered to be the fundamental values of Russia: Orthodoxy, autocracy, and nationalism. Tolstoi considered these ideals essential to preserving the strength and unity of the Russian Empire, rather than giving into the political pluralism that had developed throughout the rest of Europe. Tolstoi devoted his career to these conservative policies, most significantly by serving as Minister of Public Education from 1866-1880. Tolstoi's tenure in this role remains his de-

fining legacy, an assertion that Russian historian Allen Sinel supports in his definitive analysis of Tolstoi's educational efforts, *The Classroom and the Chancellery: State Educational Reform in Russia under Count Dmitry Tolstoi.* A majority of Russian historians disdainfully consider Tolstoi a relic of an outdated system; consequently, with the exception of Sinel's work, very little comprehensive scholarship exists on Tolstoi. Although Sinel does not attempt to defend Tolstoi, he does argue that Tolstoi exerted an incredible amount of influence on the late-tsarist era. Sinel writes,

> Aside from a few minor modifications, the fundamental changes Tolstoi introduced in elementary, secondary, and higher education shaped the Russian school system until the first decade of the twentieth century. Not only was his program the most durable of the tsarist period, but it functioned at one of the crucial times in Russian history, the era of that country's emergence from a backward agrarian society toward a modern industrialized one.[1]

Tolstoi's influence on education in Russia should not be carelessly dismissed, but rather analyzed in greater depth for the way in which he identified and reacted to some of the ideas that led directly to the revolutions of 1905 and 1917.

Since the beginning of the nineteenth century, Russia's development as a modern, civil society had challenged the tsars, who desperately desired to maintain control over the progressive ideas that began to flourish within the country's cultural and intellectual centers. Tolstoi's career in civil service really began in April 1866 when a disgruntled student attempted, unsuccessfully, to assassinate Alexander II. For the tsar and his conservative advisors, such an act of violence signaled that the reform process had to end. When Alexander asked Tolstoi to take over the Ministry of Education, Tolstoi gladly accepted the role in the hopes that an increased emphasis on moral and religious training would prevent the influence of the radical and "godless" ideas that he believed had infected the intelligentsia and youth of Russia.[2] Indeed, Tolstoi faced the vexing problem of significantly increasing the educational level in Russia while preventing the new system from arming students and teachers with the ability to undermine the stability of the autocracy.

In leading the Ministry of Education, Tolstoi oversaw a number of

useful managerial and structural resources. He supervised two advisory bodies, the Ministerial Council and the Academic Committee, and also a group of curators who served as representatives in provincial regions and reported directly to Tolstoi. An important monthly publication simply entitled *The Journal* served as a propaganda tool for the ministry as well. When Tolstoi entered into this office in 1866, he quickly surveyed the resources at his service and began to re-organize the ministry. As Sinel explains, Tolstoi "realized that he could not govern the schools of his ministry, let alone those of his competitors, without first becoming master in his own house."[3] Without the power of an unlimited budget, Tolstoi opted to surround himself with loyal followers who would respond quickly and obediently to his orders. The Ministerial Council and Academic Committee, rather than making any official decisions, found themselves serving in an advisory capacity and reporting directly to Tolstoi. In fact, Tolstoi retained the power to set the committees' agendas and to confirm or veto all of their decisions and recommendations unilaterally.

The most significant element in the restructuring of the Ministry of Education, however, concerned the role of the curators. Throughout the history of the ministry, the curators exhibited increasing authority and autonomy with little accountability to the minister. Tolstoi contended that, without direct oversight, the ministry risked allowing different curators to advocate varying educational programs. Therefore, Tolstoi chose curators who would vigorously support the official policies of the Ministry and fulfill Tolstoi's directives. Supported by what he considered effective organizational strategy, Tolstoi turned his attention to the task of controlling higher education.

Beginning in the late 1850s, liberal and progressive thought flourished within Russian universities. Tolstoi needed to gain control of the students and faculty without eliminating the main source of educated civil servants that kept the state functioning, and he thus created a plan to improve higher education by recruiting more teachers, starting better schools, and funding more research. In order to combat instability within the student population, Tolstoi proposed greater control of faculty, an increase in the monitoring of students, and a higher selectivity in the admissions process.

These directives challenged the University Regulations of June 1863, which had established significant new freedoms for both faculty and students. The statute provided for faculty elections of rectors

and deans, increased funding for research, the freedom to develop new academic programs, and protection from censorship. For students, the University Regulations established a set price for tuition throughout the Russian Empire and created opportunities for need-based scholarships.[4] The University Regulations certainly did not solve all of the problems that the universities faced, particularly in that the Regulations still did not recognize the corporate identity of students. For the first time, however, the reform era produced a statute that aligned Russian universities with their counterparts throughout Western Europe and the United States.[5]

Tolstoi began to undermine the University Regulations of 1863 almost as soon as he took office; he believed that, rather than offering faculty and students more freedoms, an increase in the bureaucracy of the university system with higher academic standards for students and greater research expectations for faculty would curtail the time spent in subversive behavior.[6] However, Tolstoi did exhibit a genuine desire to solve a number of problems within higher education. Faculty shortages, poor pedagogical practices, and the lure of foreign teaching positions plagued universities. In response to these issues, Tolstoi created stipends to entice scholars to remain in Russia to research and teach simultaneously. Tolstoi reasoned that, if he could train these faculty members in Russia, he could also shield them from the liberal and revolutionary ideas rampant throughout the rest of Europe. This program did generate some success, as the number of professors and lecturers increased in historical-philological, juridical, and medical faculties between 1868 and 1875.[7]

In regard to student unrest, however, Tolstoi mistakenly identified the presence of revolutionary ideas as the sole source of the problem. As Sinel describes,

> Unwilling to admit the legitimacy of student grievances, Tolstoi blamed outside agents, unscrupulous teachers, and unmotivated students for university disorders and demanded tighter controls over college life... Since students generally protested against specific annoyances like incompetent instruction, unfair punishments, or inadequate scholarship assistance, it is possible that a program which alleviated these problems might have placated much of the student body, thus turning them away from subversive influ-

> ences. By responding primarily with increased repression, the minister could achieve brief successes, but he ran the risk of further alienating the students.[8]

As Tolstoi unveiled restrictive measures—such as the monitoring of students by police, a ban on all corporate activity on- and off-campus, and the right of universities to expel students arbitrarily for up to three years—unrest among students only increased. Furthermore, Tolstoi ordered universities to raise admission standards and increase the academic difficulty of curriculum in order to curtail absenteeism. In 1872, Tolstoi even declared attendance mandatory at all university lectures. However, as a result of more significant issues such as bad pedagogy, poor scheduling of classes, neglect of faculty towards their responsibilities, and student poverty, poor attendance prevailed. Feeling the need to defend his reforms, Tolstoi published on official statement in the Ministry of Education's *Journal* in 1872. Tolstoi wrote,

> Our educational reform, which marked the years 1871 and 1872 and aroused so much discussion *pro* and *contra* in the press, could not but attract attention in western Europe also. Western Europe cannot be indifferent as to whether the colossal state to its east will assume definitively and permanently a European character. . . . Thanks to the wise decision of the sovereign emperor, guided by a divine Providence clearly beneficent to Russia, this question was definitely resolved in principle, that is, by means of legislation, in favor of a European education and a European character for Russia.[9]

While Tolstoi may have genuinely desired an increase in the European character of Russian universities, he completely disregarded the actual needs of the people associated with the universities. Tolstoi could not fathom any disparity between his idealistic policies and the reality of the university situation; his bureaucratic administration removed him too far from the people.

In particular, Tolstoi fundamentally misidentified the sources of student unrest. Certainly, a growing interest in liberal and revolutionary movements developed within the university environment, but Tolstoi

could not see beyond that threat to larger needs of higher education. Even professors argued that, when the state reacted strongly and harshly to quell disturbances, students would simply radicalize even faster. None of Tolstoi's policies could appease student unrest because they did not seek to solve the real problems of the universities. Faced with increasing agitation among students, Tolstoi enacted even more repressive orders, which severely limited the autonomy of the university and alienated the Ministry of Education's last ally, the faculty members.[10]

In 1879, after yet another unsuccessful assassination attempt on Alexander II, the tsar appointed General Count Michael Loris-Melikov as the Chairman of the Supreme Executive Commission to restore stability to Russia and guide the country through the process of reform. When Loris-Melikov suggested to Alexander II that Tolstoi resign, the tsar removed Tolstoi from his position at once.[11] Russian historian Edvard Radzinsky relates how this news thrilled the intelligentsia: "They called it the third emancipation: First the tsar freed the peasants from their masters, then the Bulgarians from the Turks, and now education from Tolstoy."[12] Although the faculty and students could now breathe a sigh of relief, Tolstoi's influence could still be felt in the education system and would not be thrown off completely until the Bolshevik revolution in 1917.

In many ways, Tolstoi exhibited great potential in his approach to higher education; experienced, disciplined, and goal-oriented, Tolstoi surrounded himself with those he could trust within the Ministry of Education. Tolstoi, however, ultimately could not adapt to the progressive times and changing needs within higher education. Focused on his own conservative ideals, Tolstoi eliminated his ability to enact successful change by isolating his allies and radicalizing his opponents. Tolstoi's misguided policies resulted in his own ouster as the university situation spiraled out of control.

**The Soviet Tradition and the New Reformer**

The Bolshevik Revolution in 1917 propelled Russia into yet another period of policy decisions crafted around the interests of the state, particularly in regards to education. With aggressive state planning programs requiring the participation of citizens well trained in economics, manufacturing, engineering, and a host of other technological skills, education had an integral role in the creation of the successful Soviet state. Over time, however, the static nature of Soviet bureaucracy took

its toll on education, particularly within institutions of higher learning. Many of the problems that had developed towards the end of the tsarist era began to emerge again, and calls for change went unheeded. While Mikhail Gorbachev emerged as a champion for educational reform, both the bureaucracy of a state-controlled system and the rapid collapse of the entire Soviet state ultimately undermined his effectiveness.

The Soviets primarily supported the educational system so enthusiastically because they believed that, through education, citizens would learn how to serve the interests of the state. Therefore, soon after the Bolshevik Revolution, education became a national priority. For example, although Russia maintained a 50% literacy rate until the Revolution, the ensuing years of civil war, famine, and chaos led to a significant decline in these figures. As evident throughout history, in times of great crisis, the emphasis shifts away from the building of society towards mere survival. Beginning in 1922, however, the Soviet Union initiated a massive educational program to establish schools for all children, and by 1982, about 98% of 17-18 year olds had completed secondary education.[13] Another program sought to achieve complete literacy among the adult population, and by the early 1940s, an estimated 85% of adults had accomplished this objective.[14]

The Soviet Union exerted great effort to indoctrinate youth with Soviet ideology. By utilizing traditional, disciplined practices, the Soviet school system allowed every student who exhibited ability to receive a high level of education. Within secondary schools, the curriculum centered on mathematics and science, while language, literature, and history played only a complementary role. This curriculum led to the scientific focus of Soviet institutions of higher education, which partnered well with the materialist objectives of the state. In a comprehensive study of higher education during and after the Soviet era, Michael David-Fox and György Péteri identify the goals of the Soviet Union within the universities:

> The ambitions of the party-state were enormous, even if imperfectly achieved: among them, to reshape the organization and direction of science and education to promote political, ideological, and economic objectives; to plan the creation of knowledge and to integrate academic into the broader communist system of cadre promotion; and to create a new scien-

> tific intelligentsia while using or replacing the "old" experts inherited from the ancien regime.[15]

Thus, the Soviet Union began with an ambitious plan to connect the education of the classroom directly with economic outputs that would serve as legitimizing factors for the viability of the Soviet way of life.

To achieve these goals, institutions of higher learning within the Soviet Union moved away from the kind of broad, liberal education favored by most Western universities and focused instead on educating students in a particular field, such as engineering, agriculture, medicine, or pedagogy. This systematized and discipline-specific approach also limited students' abilities to think freely and question authority, which allowed for continued Soviet ideological control.

Although students sat for competitive entrance exams to begin university studies, once admitted, they had fairly large opportunities for social and political growth, and tuition costs remained reasonable as well.[16] Soviet higher education institutions, known by the acronym VUZy (*Vyshee Uchebnoe Zavedenie*), not only focused on training highly competent professionals, but also sought to do so within environments of the highest moral quality. Without question, VUZy placed particular emphasis on understanding the cultural and personal responsibilities of supporting the Marxist-Leninist ideals of the Soviet Union. With 4,500-5,500 classroom hours of instruction completed in the course of a five-year diploma program, Soviet universities had many opportunities to indoctrinate their brightest students fully.[17]

Unfortunately, years of Soviet bureaucracy took their toll on VUZy, particularly during the infamous "era of stagnation" of Leonid Brezhnev, who served as General Secretary of the Communist Party from 1966-1982.[18] The problems that Soviet higher education faced at the beginning of the 1980s needed definite solutions, as evident in this contemporary account:

> In the last two decades higher education (in particular, engineering courses) has lost some of its prestige among young people and the general public. Academic standards are perceived to have declined. There has been constant criticism of the poor quality of VUZ training and of the failure to inculcate both technical competence and professional attitudes

> in the future leaders of the Soviet economy. Much blame is attached to the dominance in higher education pedagogy of formal lecture courses, the overloading of student timetables and the assimilation of factual material to the detriment of more active methods which might stimulate independent analytical thinking and personal initiative.[19]

The decreasing ability of universities to facilitate quality academic environments served as a barometer of a whole host of problems throughout the Soviet Union. While higher education was not alone in its need for serious change, statistical evidence based on these standards served as a strong indicator of the need for a new paradigm.

In 1980, the Soviet Union reported a total of 5.2 million students enrolled in 870 VUZy. However, projections also estimated that this number would quickly begin to decline, as the birthrate in the USSR had significantly decreased, falling from 5,341,000 births in 1960 to 4,087,000 in 1969.[20] This drop of 23.5% alarmed Soviet analysts, who understood that these trends would mean disaster for the economy if schools, and universities in particular, did not begin producing more motivated and talented students who would readily accept the task of learning in order to serve the state. The Soviet Union, however, needed more than just reforms, as perpetual calls for change over the previous twenty years had gone unheeded.

In 1984, a young Communist Party member named Mikhail Gorbachev chaired a commission on educational reform for the Politburo. Although the Soviet Union did not officially approve the proposals that emerged from this commission until 1986, Gorbachev's active leadership and vocal demands for change signaled a departure from the stagnation of the previous decades. In regard to university life, Gorbachev's reforms primarily sought to revive methods of using education to stimulate the national economy in positive ways and to improve significantly the quality of instruction and research within the colleges and universities.[21] Additionally, the reforms focused on modernizing the application process and facilitating cooperation between industry and higher education establishments in regards to the curricula and training needed before graduation. Gorbachev also supported improving faculty organization and pedagogy, reducing student and faculty workloads, establishing higher research expectations for faculty, and increasing sources of

university funding.[22]

When Gorbachev assumed power as the General Secretary of the Communist Party of the Soviet Union on March 11, 1985, he certainly had no idea that, in a little over six years, the Soviet Union would dissolve, largely as a result of his own policies of *glasnost* (openness) and *perestroika* (restructuring). Nevertheless, Gorbachev's first administrative decisions indicated his own understanding of the need for change within the antiquated bureaucracy of the Soviet Union. In an administrative shake-up, Gorbachev named Sergei Georgievich Shcherbakov as the new Minister of Education for the USSR. Gorbachev blamed the previous minister, who had held the post since 1966, for the deterioration of education in the Soviet Union. By replacing him, Gorbachev indicated his intentions to prepare the Ministry of Education for serious reforms.

The problem of entrenched hierarchy hindered effectiveness in the Soviet Union. By the end of the Soviet era, all decisions had to emanate directly from the General Secretary, as the administrative structure created an environment in which bureaucrats passed every problem either up or down the ladder of command. By naming Shcherbakov as the Minister of Education, however, Gorbachev began surrounding himself with effective subordinates who would not seek his direct approval of every decision. Gorbachev and Shcherbakov immediately began working together for education reform, and in January 1985 they jointly announced the decision to introduce computer technology into all Soviet schools, one of the first major indicators of the changes to come.[23]

Within institutions of higher education, Gorbachev initiated programs to increase the standards of teaching and learning. Gorbachev demanded that all VUZy undergo regular inspections that would result in honest reports presented directly to the Minister of Education. Moreover, universities were instructed to shift their focus to seminars, group projects, practical classes, and independent study programs, rather than timetabled lecture courses. Since VUZy curtailed admissions in order to achieve the goal of a 1:8 faculty-student ratio, such an academic focus would allow faculty members the opportunity to develop more active pedagogy that could focus on tutorials, discussions, and actual research.[24]

Significantly, Gorbachev delegated responsibilities to educators on the local level, encouraging regional bodies or even individual schools to implement teaching strategies with new and innovative peda-

gogy suited to local needs. Such empowerment undoubtedly motivated teachers. One contemporary of Gorbachev commented, "For an educational institution it is vital that freedom of thought and speech should flourish. Those schools were essentially encouraging that freedom and showing the pupils how to use it. In the long run, if this is widespread and if it continues, the result will be far-reaching and lasting educational reform."[25] Unfortunately, Gorbachev did not have the opportunity to realize the outcomes of all of his educational reforms; the turning wheels of history quickly shifted under him.

In the midst of Gorbachev's pursuit of reform, the entire Soviet system collapsed, culminating with Gorbachev's own resignation in 1991. Although Gorbachev began his reforms in education, the reorganization of *perestroika* and the openness of *glasnost* led to much more wide-ranging changes. As a leader, Gorbachev exhibited a genuine desire for positive change by removing incapable bureaucrats and attempting to fight the sluggish managerial process of the Soviet system. Most importantly, Gorbachev recognized that the needs of students extended beyond the ideals of Marxism-Leninism and therefore encouraged the higher education system to facilitate engaging learning environments that would allow both the student and the state to flourish.

**Higher Education in Post-Soviet Russia**

With the collapse of the Soviet Union and the rise of the Russian Federation, new hopes emerge for higher education in Russia. Certainly, some of the same challenges from both the tsarist and Soviet eras remain, such as balancing the interests of the state with the rights of faculty and students, or finding adequate financial resources for universities during turbulent economic times. A new spirit of autonomy, however, holds the greatest source of opportunity within Russian universities. Although the state will continue to maintain significant levels of involvement within higher education, a shift to local leadership has already promised to ensure that the decisions of the government can meet the needs of the individual campuses and other academic communities. Given their ability to move outside of the bureaucracy that severely restrained Tolstoi and Gorbachev, local university leadership can work most actively to ensure the creation of the civil society through higher education.

During the tumultuous 1990s, the newly formed Russian Federation encountered significant economic and political challenges that kept

its official concerns focused on the day-to-day survival of the state. This also influenced the amount of research conducted on post-Soviet higher education, as scholars have produced relatively few studies on this topic. The accounts that have emerged, however, often highlight the growth of autonomy and an increase in local rather than state leadership within universities.

After the collapse of the Soviet Union, Russia quickly sought to re-legitimatize its institutions of higher education. With the removal of Soviet oversight, the main responsibility for ensuring the success of universities shifted down to the individual institutions. As a result of increased autonomy, many universities have taken great liberties to develop new academic programs and to focus on the social science and humanities faculties that the Soviets often neglected.[26] This kind of freedom indicates that universities have finally embraced a twenty-first-century understanding of their role in preparing students not only to work, but also to respond to the needs of society in an attempt to improve the local, national, or global situation.

In *The Orthodox Church and Civil Society in Russia*, historian Wallace Daniel examines how religion has contributed to the growth of a new sense of culture and democracy in post-Soviet Russia. In one of many fine examples, Daniel explains how Father Maksim Kozlov has passionately worked with students and faculty at Moscow State University to revive a sense of spiritual purpose and direction within the academic environment. In particular, Fr. Maksim has sought to reintroduce the university to the importance of the spiritual life through the presence of the on-campus Church of the Sacred Martyr Tatiana. The church, closed by the Bolsheviks in 1920, has played a historically significant role in the life of the university as a source of communal space, joyous celebrations, and spiritual refuge and nourishment. Daniel writes that the post-Soviet use of the church "posits an attempt to recapture the oldest traditions of the university and to recover what is perceived to be their rightful place."[27] While the Ministry of Education may not consider this small church an essential part of its efforts to support higher education, Fr. Maksim's work in re-establishing a source of value for Moscow State University allows for the growth of unity and common purpose that will certainly translate into positive educational outcomes.

Fr. Maksim understands his role in preserving a sense of memory and identity for both the church and Moscow State University. In seeking to unite the diverse members of the university community, Fr. Maksim

works with students to publish a newspaper entitled *Tatianin Den*, which "aims to provide a counterweight to the selfish, status-driven impulses of Russian society."[28] The strength of Fr. Maksim's leadership comes from his commitment to maintaining and developing an environment integral to the identity of Moscow State University. Rather than working from any bureaucratic position, Fr. Maksim's substantial influence arises from his proximity to the university community.

Due to the openness of the post-Soviet Russian society, other opportunities for leadership have developed not just within state universities, but among private and faith-based universities as well. The 1992 law on higher education allowed for the creation of these autonomous institutions, in addition to partnerships with foreign universities for expanding educational opportunities abroad. Although independent universities do not benefit as greatly from state funding, they facilitate an unhindered pursuit of learning in a way previously unknown to Russia.[29] Such institutions are growing in popularity as well; in 2003, there were 570 private universities in Russia, enrolling over 750,000 students. Of these, 337 institutions had already completed the state accreditation process.[30]

Historian Jonathan Sutton explores the history and influence of private Russian universities in *Traditions in New Freedom*. For example, the Open Orthodox University, established in Moscow in 1990 by Father Alexander Men, is now continued by Executive Director Aleksey Bodrov, who explains that the university seeks "to explore Christian spirituality and traditions through the study of texts, religious art and related forms of study and also to examine how religion engages with the modern world." The Open Orthodox University provides opportunities for Christians in Russia to achieve a new level of informed understanding of their faith, and in an effort to convey the accessibility of higher education, the university allows students to attend first- and second-year lectures without passing an entrance exam.[31] Seeking to redress the suspicions that Orthodox believers have against western Biblical scholarship, Bodrov contends that the Open Orthodox University helps Russian believers recognize the benefits of modern scholarly analysis of the Bible.[32]

The freedom of post-Soviet Russia has allowed people such as Fr. Maksim and Aleksey Bodrov to take on significant roles of leadership in institutions of higher education. As seen through their work, local leadership can facilitate many positive opportunities for individuals to

contribute to the creation of a new culture of education in Russia. Furthermore, when the leadership focus shifts downwards to local institutions, opportunities for creative exploration develop at the initiative of scholars and administrators, rather than of bureaucrats. This approach to education also encourages the development of democracy, as the presence of independent voices in higher education enables increased critical reflection on Russian society and history.

Several issues arise when attempting to compare the work of local leaders such as Fr. Maksim and Aleksey Bodrov with bureaucratic administrators such as Dmitrii Tolstoi or Mikhail Gorbachev. The tsarist and Soviet regimes needed to craft the ideology of institutions of higher education in order to control the students and produce desired social outcomes. Tolstoi, in his urge to purge any sources of revolutionary thought from universities, ignored the problems legitimately plaguing students, such as course overload, bad pedagogy, and financial strains. As a member of the conservative bureaucracy, Tolstoi could not accustom himself to the changing political views in Russia and thus sought to use his position as Minister of Education to enact policies often in direct conflict with the liberal reforms of Alexander II.

Gorbachev, while certainly earnest in his approaches to challenging the governing paradigms of higher education in Russia, found himself constrained by political and historical forces beyond his control. Furthermore, although Gorbachev advocated change, he still had to work within a Soviet framework that aimed to facilitate specific outcomes. Gorbachev also battled the entrenched top-down bureaucratic structure of the Soviet Union, which presented almost insurmountable challenges in the process of enacting change. With the imminent collapse of the Soviet Union, Gorbachev's focus shifted away from educational reforms and towards the larger issues within the Soviet Union and around the world.

In contrast to the tsarist and Soviet eras, autonomy and diversity define the nature of higher education in Russia today. While large, state-run institutions remain the foundation of the Russian higher education system, the growth of private and religious-based universities provides new opportunities for learning and growth. Students, professors, and university administrators must actively ensure that such environments continue to prosper. While bureaucratic management of universities must exist, particularly in a country as large as Russia, new opportunities for great leadership seem to develop most actively at a local level. For

higher education in Russia to continue its role in creating civil society, academic freedom and autonomy must remain a priority.

## NOTES

[1] Sinel, *The Classroom and the Chancellery*, vii.
[2] Ibid., 35-36.
[3] Ibid., 57.
[4] Vernadsky, *Alexander II to the February Revolution*, 610-11.
[5] Kassow, "The University Statute of 1863," 249.
[6] Ibid., 257.
[7] Sinel, *The Classroom and the Chancellery*, 88.
[8] Ibid., 93-94.
[9] Vernadsky, *Alexander II to the February Revolution*, 624.
[10] Sinel, *The Classroom and the Chancellery*, 129.
[11] Riasanovsky, *A History of Russia*, 356.
[12] Radzinsky, *Alexander II*, 360. (Radzinsky uses an alternate spelling of Tolstoi.)
[13] Zajda, "Recent Educational Reforms," 418.
[14] Riasanovsky, *A History of Russia*, 568.
[15] David-Fox, "On the Origins and Demise," 4.
[16] Riasanovsky, *A History of Russia*, 569-70.
[17] Zajda, "Recent Educational Reforms in the USSR," 411-12.
[18] Szekely, "The New Soviet Educational Reform," 321.
[19] Avis, "The Soviet Higher Education Reform," 6.
[20] Zajda, "Recent Educational Reforms in the USSR," 411-17.
[21] Avis, "The Soviet Higher Education Reform," 6.
[22] Muckle, "Education," 52-53.
[23] Szekely, "The New Soviet Educational Reform," 326-30.
[24] Avis, "The Soviet Higher Education Reform," 7-8.
[25] Muckle, "Education," 65.
[26] Fortescue, "The Academy versus the Rest," 230.
[27] Daniel, *The Orthodox Church and Civil Society*, 154.
[28] Ibid., 161.
[29] Zajda, *Schooling the New Russians*, 89.
[30] Glanzer, "Religion and Education in Post-Communist Russia," 71.
[31] Sutton, *Traditions in New Freedom*, 16.
[32] Ibid., 20.

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*Benito Feijoo and Gaspar Jovellanos, two influential thinkers in eighteenth-century Spain, witnessed and commented on their society's stagnated intellectual activity. While the rest of Europe flourished intellectually during the Enlightenment, Spain remained a step behind. This paper examines the concerns raised in key works by Feijoo and Jovellanos, revealing the various factors contributing to Spain's lack of scientific progress in the eighteenth century.*

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# Benito Feijoo and Gaspar Jovellanos: Critics of Intellectual Stagnation in Eighteenth-Century Spain

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The eighteenth century in Europe is widely regarded as a time of intellectual growth and scientific progress. The Enlightenment produced key thinkers who revolutionized the world's perspectives on scientific thought and discovery. While most European countries flourished in this era of intellectual fervor, Spain remained a step behind its neighbors. The lack of intellectual progress was not due to a lack of strong intellectuals, but rather to internal conflicts and the re-emergence of religious traditions that dominated Spanish intellectual activities. The internal conflicts were fueled by several wars of succession for the Spanish throne, while the re-emergence of fundamental religious ideals was centered on increasing the presence and power of the Catholic Church in all spheres of activity. This stultifying combination created an inwardly focused environment not conducive for intellectual growth.

Several Spanish authors in the eighteenth century noticed their country's stagnation in the sciences and used their gift of writing to raise questions regarding the source of Spain's dormancy in the intellectual arena. Benito Feijoo (1676-1764), grounding his thoughts in his vocation as a Benedictine monk, wrote *Cartas eruditas* [Intellectual Letters][1] (1742-1760) and *Teatro crítico universal* [Universal Theater of Criticism][2] (1739) which included essays highlighting the lack of scientific progress in Spain. Shortly thereafter, Gaspar Jovellanos (1744-1811), rooted in his strong stance supporting educational reform, raised similar concerns in

his *Oración sobre la necesidad de unir el estudio de la literatura al de las ciencias* [Lecture Regarding the Necessity of Uniting the Study of Literature and the Sciences] (1797) and various other writings. These key eighteenth-century thinkers used their works to expose the lack of intellectual progress plaguing their country. This essay seeks to analyze the questions raised by each of these authors by carefully observing their respective texts. First, the state of Spain and the historical context within which these writers wrote had a significant impact on their writing. Subsequently, this analysis will first focus on Feijoo, and then progress chronologically to Jovellanos, showing how each thinker's formative ideologies and specific texts diagnose the causes of the lack of scientific progress in eighteenth-century Spain.

**The State of Spain in the Eighteenth Century**

An analysis of Feijoo's and Jovellanos's works requires an understanding of the context in which they wrote. Backwardness rooted deeply in its aging heritage and stagnant culture hindered the progress of Enlightenment-based scientific inquiry in eighteenth-century Spain. As a minority of key thinkers, civic leaders, and laborers of Spain advocated intellectual and economic progress like its European counterparts, the majority of Spaniards, largely influenced by the Church, opposed such goals, clinging to backward ideas and an egocentric belief that Spanish traditions were superior to anything foreign. Most historians agree that this century was a forgettable one, with very few of the contributions to the Enlightenment that many of Spain's neighbors enjoyed. Historian Carmen Pereira-Muro describes the eighteenth century in the following manner:

> Probablemente no hayas oído nunca muchas cosas sobre [el siglo XVIII], y no es extraño. En este siglo no vamos a encontrar grandes héroes, escritores o artistas de fama mundial. […] el siglo XIII es muchas veces percibido como un siglo mediocre y gris, sin interés alguno. Según esta visión negativa, en este siglo España ya no es importante para el mundo. (152)
>
> [You have probably not heard many things about the eighteenth century, and that's not strange. In this

> century we will not find grand heroes, writers, or artists of worldly fame. […] The eighteenth century is often perceived as a mediocre and grey century, without a single interest. According to this negative vision, this century in Spain is not important to the entire world.]

Additionally, historian I. L. McClelland describes the early decades of the eighteenth century as "fallow years of mental re-adjustment involving, severally or together, curiosity, distrust, confusion, passive and active assimilation, hesitation and unease" (*Ideological* 9). Obviously, these were not the right ingredients for a society hoping to leap forward in the Enlightenment.

Instead, Spain remained at the tail end of the race to modern intellectualism, with the reliance on religious traditions largely at fault. Popular historian Peter Pierson writes, "Religion remained a major prop of government alongside habit, personal loyalties, patriotism, and fear. [. . .] The clergy numbered some 200,000 men and women in a population of nearly 10 million" (78). The continued influence of the Catholic Church on daily life even took predominance in the economic affairs of the country, as "Enlightenment intellectuals thought its land management backward" because "the Church was the single largest landowner in the realm" (Pierson 78). In addition, eighteenth-century Spain expert Richard Herr notes that "economic reforms could not be carried out without disturbing the tithes of the clergy" (8). The large role of the Catholic Church was quite unusual in the European Enlightenment, as Protestantism arrived hand-in-hand with intellectual activity in other countries. However, "because of the stricter control of thought in Catholic countries, Protestant lands were in general the first scene of the new development" (Herr 3).

Religious issues also created an unstable education system in Spain, as "the church had a near monopoly of instruction and imparted an increasingly discredited classical and scholastic education" (Herr 8). The availability of education and the scope of materials accessible to the Spaniards were diminished greatly by the Inquisition, run by the Church, whose task was "to censor the reading matter of Spanish subjects" (Herr 205). The budding intellectual exercised caution, because "to own or read books which had been prohibited or had not been properly expurgated was a sin" and could lead to excommunication (Herr 205).

A large majority of the Spanish lower class remained illiterate, lacking a sturdy educational foundation. With the eighteenth century witnessing a corrupt and stagnant educational system, educational reform would thus become a focal point of Jovellanos's works.

Finally, internal conflicts contributed to Spain's stagnancy in the eighteenth century. The arrival of the Bourbon Kings, a new lineage of royalty from France, catalyzed years of internal conflict in Spain. Spaniards who remained loyal to the Hapsburg dynasty expressed their dislike of the Bourbons, and the tensions only rose as the Spanish War of Succession crippled the country. These internal issues, combined with the religious influences and the faulty educational system, characterized eighteenth-century Spain. More importantly, these problems set the stage and provided the catalyst for thinkers such as Feijoo and Jovellanos to analyze and criticize their country's backwardness in intellectual activity.

**Feijoo's Intellectual Stances**

Various components of Feijoo's youth and his early education contributed to his intellectual stances. Feijoo was born in the Galician village of Casdemiro on October 8, 1676. This northwest region of Spain was best known for its dual character: it was rich with pride of its ancient heritage, while also being cognizant of the flourishing activity across the seas to the North and the Portuguese border to the west and south (McClelland, *Benito* 2). Feijoo moved to Oviedo in 1709, where he began studying for his doctoral degree in theology (Ibarra 7). This new educational endeavor strengthened the foundation for his strong stances regarding Spain's intellectual status, as Oviedo's proximity to the seaport of Gijon brought Feijoo ideas and objects from the distant reaches of the world. [3]

As Feijoo's status as professor at the University of Oviedo rose during his many years there, so too did his interest in foreign books and the growing scientific activity occurring beyond Spain's borders. Feijoo's curiosity was focused on "what was being said beyond the Pyrenees and [he] realized the intellectual backwardness of his country" (Herr 38). For years, Feijoo continued to teach at the university and research foreign affairs until he reached the age of fifty, when he finally published his collection of essays entitled *Teatro crítico universal* (1739). During the next thirteen years, Feijoo would go on to publish nine volumes of this literary collage of his thoughts, reflections, and analyses on a myriad of topics. In this encyclopedic work, he explored everything from

discourses on medicine to comparisons between Castilian Spanish and the French language. Five other volumes soon followed, and became known as his *Cartas eruditas* (1742-1760). These two literary works are the most frequently read and cited by those who wish to delve into Feijoo's thinking and understand his position on intellectual activity, or lack thereof, in Spain.

It is difficult to pinpoint a specific subject matter or topic on which Feijoo concentrated in his works. A complete analysis of his various published writings reveals his subject matter to be all-encompassing. *Teatro crítico universal* and *Cartas eruditas* explore all of the major intellectual or academic disciplines of his century, including theology, philosophy, art, literature, physical sciences, history, geography, etc. Yet an enduring theme woven throughout his various discourses on each of these subjects is the need for forward progress in the intellectual realm. Feijoo's unique perspective included both international and domestic intellectual activity, and he clearly highlighted the disparity between the two.

Surprisingly, Feijoo, a trained theologian, did not believe that a lack of theology was the root of Spain's problems. Nor was a lack of religious unity the issue at hand. Rather, what Spain truly lacked was forward progress in the sciences (Herr 38). Author Alberto Navarro Gonzalez expresses Feijoo's attitude in the following manner:

> el benedictino gallego va a adoptar dos claras actitudes; una, defender la existencia de la ciencia española y la capacidad científica del español; otra, reconocer el presente estancamiento y retraso científico español, tratando de averiguar sus causes y ponerle remedio. (Gonzalez 368)
>
> [the Benedictine Galician adopts two clear attitudes: one, to defend the existence of Spanish science and the scientific capacity of the Spaniard; the other, to remember the present stagnation and backwardness of the Spanish scientist, trying to figure out its causes and find a remedy.]

Feijoo's unique stance in this regard seemed to contradict his many years as a trained monk and professor of theology. Yet for him, there

existed no discord between the sciences and religion. "Modern science did not necessarily clash with religion, Feijoo maintained, asserting that the sway of Aristotle in Spanish education could be broken without harm to the Catholic faith" (Herr 38). While this unorthodox stance might have alarmed a Spain so deeply rooted in its religious beliefs, the reality was that Feijoo's stances were met with unprecedented acceptance and recognition. Feijoo was known as "a man of academic and moral integrity, with an international reputation, who was supported in his own country by its best scholars and by the King, Fernando VI" (McClelland, *Benito* 22). No matter how contrary his stances were to the strong traditions of his country, Feijoo remained a prominent figure in the eyes of the Spanish people.

With a sturdy educational foundation in place, and with the support of both the lay people and nobility, Feijoo took a role as a literary pioneer, and his purposes and goals for writing became evident as his works became more popular throughout the country. Feijoo's purposes included the following key components:

> to hold the true balance; to free facts from the cobwebs of superstition and prejudice; to prove that they in no way invalidate Christian belief; that, on the contrary, they confirm it; to refuse to go to either easy extreme of blind piety or of wholesale materialism; to separate the true from the false; to suspend judgment in cases of insufficient evidence; therefore to be less spectacular than the dogmatic scholar but more honest. (McClelland, *Benito* 23)

For Feijoo, intellectual growth could bring the "true balance" and "honesty" that defined his literary and scholarly initiatives. More specifically, the pursuit of scientific knowledge could provide Spain with the empirical and physical "evidence" that would rid his country of its superstitions and religious falsehoods. Fernando Ibarra, in his biographical introduction of Feijoo, observed the following,

> Feijoo tiene un propósito decidido: luchar contra el atraso cultural, pero sobre todo contra la infantil credibilidad de sus compatriotas. […] Piensa que el medio mejor para arrancar la superstición y las falsas

> creencias, es dar a conocer las explicaciones científicas de los fenómenos ordinarios en la vida diaria. (Ibarra 7)
>
> [Feijoo has a definite purpose: to fight against the cultural backwardness, but above all else against the childish beliefs of his fellow countrymen. Feijoo thinks that the best method to uproot superstition and false beliefs is to offer the scientific explanations behind ordinary phenomenon in daily life.]

It is evident that Feijoo's insistence on intellectual progress was rooted in his goal of bettering his country and raising the intellectual activities of his fellow Spaniards. Only through scientific thought could daily life be improved, and more importantly, could Spanish society flourish, moving away from its backwardness and intellectual stagnation.

Finally, an analysis of Feijoo's key texts requires a keen understanding of how he viewed Spanish society. Feijoo clearly delineates a disparity between two vibrant societal groups in Spain: the "ilustrados," or the enlightened, and the "vulgo," or the common people. The *ilustrados* were the modern thinkers, like Feijoo, who rooted their intellectual ideals in a strong sense of reason and rationality. For them, "irrational ignorance and prejudice certainly were factors with which to reckon" (McClelland, *Ideological* 1). These *ilustrados* were typically the most intelligent in society, and they felt moved towards public responsibility. In stark contrast to these intellectual folk, the remainder of society constituted the *vulgo*, or "common herd," who were in conflict with the rational reform of the *ilustrados* (McClelland, *Ideological* 2). According to Feijoo, the *vulgo* included all the mentally inactive people who willingly accepted anything due to their love for sensationalism and their susceptibility to peer persuasion. This group also included closed-minded folk unwilling to change, clergy who allowed superstition to pervert their faith, and beggars who had no initiative to find work. For Feijoo, the *vulgo* was an all-encompassing term for each person in society lacking mental fortitude and purpose.

Feijoo believed that the Spanish *vulgo* was plagued by its tendency to live in the past and dwell in historic traditions and practices. Feijoo's basic realization of this societal component, the *vulgo* class, sets the stage for an analysis of his literary works. The *vulgo*, in essence, was Feijoo's target audience whom he hoped to change and shape with the power

of his word. *Teatro crítico universal* and *Cartas eruditas* served as two of his major tools in the initiative to bring reason to the *vulgo*. In each of these compilations, Feijoo not only exposed the *vulgo* to the stagnation that plagued Spain, but also gave distinct reasons as to why the *vulgo* had been living in an environment completely incapable of scientific progress, in an effort to prod them out of their lethargy.

**Feijoo's *Cartas eruditas***

Feijoo's *Cartas eruditas* is a collection of various letters on a variety of themes. Feijoo employs logic, clarity, and eloquence in these letters to highlight some of the serious problems in Spain during the eighteenth century. While many of the letters serve to reveal and analyze the issues plaguing the Spaniards in the Enlightenment, one key letter hones in on Feijoo's strong stance regarding the lack of intellectual activity in Spain. The sixteenth letter in the second volume of *Cartas eruditas* entitled "Causas del atraso que se padece en España en orden a las ciencias naturales" [Causes of the Delay which Spain Suffered with Regards to the Natural Sciences] highlights several reasons for Spain's lack of progress in the sciences. The letter, written in 1745, offers an excellent example of a Neoclassical work, with several key attributes which contribute to its clarity. Its starting point, its structure and organization, and its thematic material are all crucial elements of this particular letter, and are key tools in Feijoo's criticism of his Spanish society.

The starting point of a written work, the way in which the author starts the discussion of his theme, shapes the essay that follows. In *Cartas eruditas*, Feijoo uses the form of a letter in order to respond to questions raised in and about his society. Each letter in the collection begins with "Muy señor mío" [Dear Sir] because the author ostensibly responds to a letter from "vuestra merced," [Your Honor/Majesty] probably representing the king (Feijoo, *Cartas* 8). In the first paragraph, the reader can find the main purpose of this letter outlined as well. Here, Feijoo seeks to define and offer examples of the causes of the scientific delay in his country, which he calls the "cortos y lentos progresos" [short and slow progress] in Spain. Significantly, this point of departure has its foundation in Feijoo's experiences in his society. His emphasis on the critique of one's social environment is characteristic of Neoclassical work. Feijoo's experience as a Benedictine monk, a trained theologian, and a professor is key in his critique of Spanish society, contributing to his success in conveying his argument in this letter.

The organization and structure of this letter also contribute to Feijoo's message. Like his fellow Enlightenment colleagues, Feijoo writes with an emphasis on reason and logic, evident in the letter through its clear structure and logical progression. The first half of the letter delineates six causes for the lack of intellectual progress in Spain. First, Feijoo mentions the narrow scope of knowledge held by most professors in Spain. Feijoo describes them in the following manner, "[Los profesores] viven tan satisfechos de su saber, como si poseyesen toda la enciclopedia" [The professors live so satisfied of their knowledge, as if they possessed the entire encyclopedia] (Feijoo, *Cartas* 8). The second cause is the preoccupation in Spain against new and modern things. Here, Feijoo notes that the country has no interest in discovering new things; rather, the Spaniards indulge in reliving their own past. The third cause is the concept that new philosophies are reduced to useless curiosities. To elaborate, Feijoo uses his own experiences, relating them to the theme and tone of the letter. The fourth cause is the lack of knowledge that plagues modern thinkers and philosophers. Fifth, Feijoo describes the jealousy and fear that new doctrines will damage religion. The sixth reason for the scientific stagnation in Spain is an issue of Spanish identity. Here, Feijoo reveals a negative attitude that Spaniards possess towards intellectual progress, and the ability of such an attitude to spread throughout the country as a false identity. Explaining this attitude is the foundation for the second half of the letter, in which Feijoo adds more of his experience as well as examples to advance his claim further.

In addition to structure and organization, Feijoo uses other esthetic details to criticize the lack of progression in Spanish society. For example, Feijoo mentions several examples from history to elaborate his six aforementioned causes for the lack of intellectual progress. Many of these examples have an emphasis on Latin or Greek figures. When Feijoo describes his second cause, he mentions Latin and Greek figures such as Leucipo, Poseidon (from mythology), and Aristotle. In addition, Feijoo mentions the philosophy of Descartes and Newton, the chemistry of Robert Boyle, and the many manufactured goods in London. In these examples Feijoo emphasizes the progress of other countries in Europe to contrast with Spain's backwardness. In this manner, Feijoo negatively compares Spain to its European colleagues. In addition to these references, Feijoo also introduces religion in order to make his claim. Feijoo writes of the "Santo Tribunal" referring to the

Inquisition, the sacred sciences, and even a comparison of "el Poncio de Aguirre" to "Poncio Pilato" (Feijoo, *Cartas* 10).[4] Feijoo's use of history, Latin and Greek influences, and a subtle infusion of religion are all key components of this letter as he explains Spain's "atraso cultural," or cultural backwardness. He specifically attacks the scholastic writers steeped in classical writings but unaware of contemporary scholarship. As he critiques them, he simultaneously shows his own classical training on which his knowledge of contemporary scholarship rests.

Various details and components of this letter contribute to its success, but one must simply observe the work from its broadest perspective in order to understand and appreciate its most profound theme. The reality is that Feijoo uses all of his experience, his eloquence, and his passion to critique the society in which he lived. Feijoo wishes to reveal how far behind Spain is in comparison to the more advanced countries in the world. Feijoo's best method in conveying his message probably comes at the end of the letter, which he concludes with a joke. In the joke, Charles II of England sends a two-man committee to seek a letter of introduction to the governor of the Canary Islands from a Spanish ambassador so they could voyage to the peak of Tenerife, a mountain in the Canary Islands. The Spanish ambassador immediately assumes the committee's purpose is related to the money abundant in the many wineries on the islands:

> El Embajador, juzgando que aquella diputación era de alguna compañía de mercaderes, que querían hacer algún empleo considerable en el excelente licor que producen aquellas islas, les preguntó que cantidad de vino querían comprar. Respondieron los diputados que no pensaban en eso, sine en pesar el aire sobre la altura del pico de Tenerife. (Feijoo, *Cartas* 14)
>
> [The Ambassador, judging that the delegation was from some company of salesmen that wanted to make some considerable use of the excellent liquor that is produced in the islands, asked them how much wine they wanted to buy. The delegates responded that they were not interested in wine, but rather in weighing the air at the top of the peak in Tenerife.]

When the English travelers explain to the Spanish ambassador that they want to carry out experiments on the weight of the air atop the peak, he quickly dismisses them and tells the Spanish king of the crazy Englishmen:

> No bien lo oyó el buen señor, cuando los mandó echar de casa por locos, y al momento paso al Palacio de Withea a decir al Rey y a todos los palaciegos, que habían ido a su casa dos locos, con a graciosa extravagancia de decir que querían pesar el aire. (Feijoo, *Cartas* 14)
>
> [The good man had no sooner heard it, when he ordered them thrown out of the house as crazy people. He immediately went to the Palace of Withea to tell the King and all of the palace residents that two crazy people had gone his house with the ridiculously funny idea of saying they wanted to weigh air.]

The key point of the joke is that the English carry out advanced scientific experiments while Spain has such limited scientific knowledge. The Spanish ambassador dismisses them as crazy, thereby making himself look silly and ignorant. The joke shows the necessity that Spain progress in the realm of sciences like neighboring countries. In addition, the use of this joke to conclude the letter underscores the central theme of this work: the ignorance of the Spaniards causes a national embarrassment which is not a laughing matter.

*Cartas eruditas* is a prime example of eighteenth-century Spanish literature that aims to expose the intellectual malady of the epoch. With its clear structure, elegant and direct language, its references to Latin and Greek as well as contemporary foreign writers, and its criticism of Spanish society, *Cartas eruditas* represents a key text of the Enlightenment in Spain and of the Neoclassical movement. Feijoo's letter serves as a window through which he gives the reader a unique view of Spanish society, the culture, and the attitude during the eighteenth century. Thus Feijoo invites the reader to share his perspective of a Spanish society so focused on its tradition and heritage, that it makes no forward progress in the natural sciences, implicitly encouraging them to modernize.

**Feijoo's *Teatro crítico universal***

*Teatro crítico universal*, or, the *Universal Theater of Criticism*, is arguably Feijoo's best work. A literary collage of essays on various topics, the entire work was never really intended to be published as a whole, which is evident from the mere fact that each volume is "composed of a number of heterogeneous Discourses, of varying lengths and values, assembled in no obvious order save that in which their subjects had caught the writer's interest" (McClelland, *Benito* 41). Yet, despite the seeming lack of cohesiveness among the various essays and their incongruent topics, an underlying theme and purpose runs throughout the entire collection. The intriguing themes which Feijoo analyzed, everything from medicine to astrology and even language studies, collectively imparted Feijoo's simple, yet powerful message: Spain was quickly spiraling downward in the arena of intellectual thought, and its strong culture and reliance on religious tradition were to blame.

Despite receiving initial criticism from Spanish literary critics, *Teatro crítico* actually rose in popularity soon after its publication. "Within six years, the first volume of his *Teatro crítico* had been reprinted four times. The first editions of the fifth and sixth volumes were of three thousand copies, a tremendous issue for Spain at this time. Fifteen editions of *Teatro crítico* were made before 1786, in a period when it was unusual for a book to be reprinted at all" (Herr 40). In a matter of years, Feijoo became a key figure in Spanish Enlightenment thought and was deemed the resident expert in all things intellectual, largely due to the myriad topics discussed in his *Teatro crítico*. Among the many themes covered in *Teatro crítico*, discourses on the state of medicine and the religious restrictions on scientific thought reflect Feijoo's concern about Spain's intellectual stagnation.

As Feijoo aimed to reveal the stagnation in the Spanish sciences, it seemed only fitting for him to expose his growing doubts about Spanish medicine. While Feijoo was skeptical of many aspects of Spanish society, he took an increased interest in the failing medical system and, in particular, the "even worse fact that the average practitioner believed or professed to believe in the infallibility of his own school of thought for all times and all possible forms of disease" (McClelland, *Benito* 61). For Feijoo, there existed three states or *estados* of medicine, which he eloquently outlines at the starting point of his essay entitled *Medicina*, or medicine. Feijoo describes perfection, imperfection and corruption in the following manner:

> El estado de perfección en la Medicina es el de la posibilidad, y posibilidad, a lo que yo entiendo, muy remota. Poco o ninguna esperanza hay de que los hombres lleguen a comprender, como se necesita, todas las enfermedades, ni averiguar sus remedios específicos, salvo que sea por vía de revelación. Pero, por lo menos hasta ahora, estamos bien distantes de esa dicha. El estado de imperfección es el que tiene la Medicina en el conocimiento y práctica de los médicos sabios. Y el de corrupción el que tiene en el error y abuso de los idiotas. (Feijoo, *Teatro* 108)
>
> [The state of perfection in medicine is that of possibility, a possibility, which I understand, is very remote. There is little to no hope that the men will come to understand, as it should be, all diseases; nor to figure out the specific remedies, unless it be by divine revelation. But, at least for now, we are far from this good fortune. The state of imperfection is that which medicine has in the understanding and practice of the knowledgeable physicians. And the state of corruption is brought upon by the error and abuse of the idiots.]

For Feijoo, perfection in medicine is far from attainable due to the imperfection and corruption that plagues the practice and its practitioners.

Feijoo's discourse on medicine also includes a lengthy discussion of bleeding and purging, as the practice of blood-letting was common during his time. While the purging, or evacuation, of blood from a diseased individual was a reasonable practice in its day, Feijoo remained interested in the development of new discoveries and novel methods regarding blood circulation. His curiosity fueled an intense criticism of this practice, as he notes in the following, "Si [los purgantes] son útiles en tales o tales enfermedades, en tal o tal tiempo de ella, está en cuestión. Con que el daño es cierto, y el provecho dudoso" [Whether the purgatives are useful in such and such diseases, and in such and such time, is in question. Nevertheless, the danger is certain and the benefits doubtful]

(Feijoo, *Teatro* 133). Feijoo questions the effectiveness of purging blood and in which scenarios or maladies this practice is truly helpful for one's health and recovery from illness. Though not officially trained in the art of blood-letting, Feijoo "showed his acumen by recognizing the importance of new knowledge on blood groups and experiments in blood transfusion" (McClelland, *Benito* 66). In this manner, as in many of his essays in *Teatro crítico*, Feijoo utilizes his curiosity and interest in modernization to reveal the antiquity of many Spanish practices.

Another theme woven throughout Feijoo's *Teatro crítico* is the various religious restrictions on scientific thought. As mentioned previously, Spain's insistence on its Catholicism and religious traditions created an impediment for scientific progress. Feijoo tackles this problem in *Teatro crítico*. Although "he did not devote a Discourse exclusively to the question of where the authority of a scientist must end and that of the Church take over," McClelland writes, "his scattered comments, together with all his incidental assumptions in this respect, build up for any unprejudiced reader a perfectly consistent standard of values" (*Benito* 48). For Feijoo, religion placed two major impediments on scientific thought. First, he suggests that the essential characteristics of the Catholic faith can be "defended for all time by the Church's traditional method of reasoning, against any possible opponent, however scientific" (McClelland, *Benito* 49). Feijoo witnessed his society's tendency to believe that there was a clear distinction between the finite doctrine of the Church's reasoning and the scientific method of reasoning. The second impediment was the tendency of Spaniards to believe that the Old and New Testaments were "literal and factual in every detail" (McClelland, *Benito* 49). Feijoo noticed a growing concern in the realm of religious thought that a completely literal interpretation of the Bible would leave little room for intellectual and scientific advancement. These two impediments, mentioned throughout his *Teatro crítico*, raised significant questions about Spain's lagging intellectual abilities due to its conservative views on its Catholic faith.

Without a doubt, Feijoo played an instrumental role in revealing and questioning the lack of scientific progress in Spain. Armed with an intense curiosity for new developments from abroad, and an open-minded stance on the role of faith in Spanish culture, Feijoo embarked on a journey to rouse the *vulgo* of Spain from its intellectual dormancy. Perhaps Juan Sempere y Guarinos, a contemporary of Feijoo, most eloquently described Feijoo's contributions to Spanish society: "The

works of this man produced a useful fermentation, they made us begin to doubt, they made known other books very different from those there were in the country, they aroused curiosity, and they opened to reason the door which had been closed by indolence and false knowledge" (qtd. in Herr 40-41). While Feijoo was successful in revealing the problems that plagued Spain, unfortunately the battle was far from over. The questions he raised were further examined by his contemporaries, one of whom, Gaspar Jovellanos, also wrote extensively on Spain's backwardness in many fields.

**Jovellanos and Educational Reform**

While Benito Feijoo called Oviedo home for numerous years, Gaspar Jovellanos was born in the nearby seaport of Gijon on January 5, 1744. Jovellanos was born at the end of Philip V's rule and could bear witness to Philip V's attempts at reforming Spanish society.[5] Positive reforms, such as the formation of academies and libraries, occurred during this time and were continued under the ensuing reigns of Ferdinand VI (1746-1759) and Charles III (1759-1788). However, Jovellanos soon noticed the inadequacy of these reforms, as professors throughout Spain continued to favor a more classical and conservative approach to education.

The death of Charles III in 1788 brought both the rule of Charles IV and the beginnings of tension with neighboring France. Jovellanos's passionate interests in educational reform found no outlet in Charles IV's court, and he retreated back to his native Gijon, away from the politics and external affairs plaguing the capital. Nevertheless, even away from the center of Spanish politics, Jovellanos remained mentally active, and his passion for educational reform intensified with his dedication to modernizing Spanish curriculum and, thus, modernizing Spain's backwards intellectual and educational activities.

Education, for Jovellanos, took center stage in the discussion of Spain's much needed reforms. J. H. R. Polt writes that Jovellanos saw education as "the heart of the Enlightenment" and "the key to a better future" (106). His critical eye for the state of Spanish education in his time revealed many disheartening details. First, "primary education, though widely accessible, was by no means universal, so that many peasants and laborers remained illiterate" (Polt 107). Second, Jovellanos noticed the limited scope and availability of secondary education in Spain, which emphasized the humanities too heavily, and which did not train the

masses for their economic roles in Spanish society. Latin was still the preferred language of higher education institutions, thereby allowing only the very few who were proficient in Latin access to advanced studies. Thus, a large focus of Jovellanos's plan for reform included the "substitution of Spanish for Latin as the language of instruction" (Polt 26). His efforts were somewhat fruitful, as secondary schools began to introduce new fields of study into their curricula, including modern foreign languages, natural sciences, and political science. State schools soon began to adopt these more modern disciplines, and Jovellanos's influence spread throughout the country.

At the university level, however, Jovellanos's efforts met with harsh criticism from the tenured professors. Universities in Spain, including the famed Salamanca and Alcalá, tended to "resist intellectual and curricular innovation," and the less reputable institutions "had become little more than diploma factories" (Polt 107). The core discipline of the major universities in Spain was theology, similar to the educational environment in which Feijoo received his formal training. However, as Feijoo and then Jovellanos demonstrated, Spain needed much more than theology at the university level to progress intellectually as the rest of Europe had done. Higher education in Spain was desperate for a fresh perspective and dynamic modernization.

Though reform of the Spanish education system was of great importance to Jovellanos, the scope of his concern also included providing access to education for the poor and for those who traditionally did not attend schools. Jovellanos was a strong proponent of vocational training for the poor, equal education for women, and theological training for nuns. His dedication to the education of every Spanish individual is a theme present in most of his writings on educational reform. Jovellanos grounded his stance on education in his belief that each individual is an integral part of society, "so that the progress of society requires the education of the individual and the welfare of the individual requires that he be taught to live in society" (Polt 121). For Jovellanos, the reform of education not only benefits the individual, but also results in the betterment of society as a whole, a belief which echoes Feijoo's thoughts from prior decades.

**Jovellanos's "Oración sobre la necesidad de unir el estudio de la literatura al de las ciencias"**

An exploration of Jovellanos's multitude of works reveals writing

in various genres. From prose to poetry, lectures to informal notes, Jovellanos's literary output took various forms. As a celebrated reformer of education and a notable figure in the political arena, Jovellanos often used public lectures and speeches as a medium for spreading his strong stances. One such public lecture was his "Oración sobre la necesidad de unir el estudio de la literatura al de las ciencias" given in 1797. In it, Jovellanos explains the need to unite the study of literature and the sciences. He places much emphasis and importance on the sciences, describing them in the following manner:

> Las ciencias serán siempre a mis ojos el primero, el más digno objeto de vuestra educación; ellas solas pueden ilustrar vuestro espíritu, ellas solas enriquecerse, ellas solas comunicaros el precioso tesoro de verdades que nos ha transmitido la antigüedad, y disponer vuestros ánimos a adquirir otras nuevas y aumentar más y más este rico depósito; ellas solas pueden poner termino a tantas inútiles disputas y a tantas absurdas opiniones; y ellas, en fin, disipando la tenebrosa atmósfera de errores que gira sobre la tierra, pueden difundir algún día aquella plenitud de luces y conocimientos que realza la nobleza de la humana especie. (Jovellanos, "Oración")
>
> [The sciences will always be first in my eyes, the most worthy object of your education; only the sciences can enlighten your spirit, they alone enrich you, only the sciences can communicate to you the precious treasure of truths that antiquity has brought us and arrange your spirit to acquire new things and increase more and more this rich store; only science can put an end to so many useless disputes and to so many absurd opinions; and finally, only science can dispel the gloomy atmosphere of errors that blow all over the land, only science can spread that plentitude of lights and knowledge that brings out the nobility of the human species.]

Jovellanos shows science in the most positive of lights, underscoring

the importance of its study. For him, increased intellectual activity in the sciences becomes the solution for ridding Spain of its backwardness and lack of productivity.

However, Jovellanos opines that the sciences should not be studied in isolation. Rather, he suggests that the study of literature and science be unified, as each complements the other. The relationship between science and literature is symbiotic, each contributing something beneficial to education and to intellectual progress. Jovellanos expresses this sentiment in the following manner: "Las ciencias rectifican el juicio y le dan exactitud y firmeza" [The sciences rectify judgment, and give it precision and firmness], Jovellanos writes, while "la literatura le da discernimiento y gusto, y la hermosea y perfecciona" [literature gives discernment and taste, and beautifies and perfects it.] (Jovellanos, "Oración"). According to Jovellanos, science provides proof, logic, and verisimilitude, while literature brings depth, creativity, and eloquence into the picture. The combination of the two fields creates an outlet for a well-rounded education, one in which the student becomes knowledgeable in two very important aspects of intellectual growth.

The possibility of honing in on only one of these fields, either science or literature, would be a detriment to one's educational endeavors, Jovellanos argues. He then describes the subdivision of the sciences from literature in the following manner: "mas de esta subdivisión, tan provechosa al progreso, fue muy funesta al estado de las ciencias, y al paso que extendía sus limites, iba dificultando su adquisición" [more than this subdivision, so beneficial to progress, was very detrimental to the state of the sciences, and as it went extending its limits, it made it increasingly difficult to acquire (knowledge of science)] (Jovellanos, "Oración"). Jovellanos admits that the sole concentration on one field will allow for more intense study and a wider scope of study; however, it will limit the learner to only one perspective. To illustrate this stance better, Jovellanos uses symbolism by describing the following:

> Como no se ha echado de ver que, truncado el árbol de la sabiduría, separada la raíz de su tronco, y del tronco sus grandes ramas, y desmembrando y esparciendo todos sus vástagos, se destruía aquel enlace, aquella intima unión que tienen entre si todos los conocimientos humanos. (Jovellanos, "Oración")

> [As he hasn't come to see that the tree of knowledge being truncated, the root separated from its trunk, and the trunk from its largest branches, and dismembering and scattering all of its shoots, destroyed it and that tie, that intimate union that exists among all (branches of) human knowledge.]

Using the parts of a tree as a metaphor, Jovellanos questions the importance and validity of separated sectors of knowledge. If each part is no longer connected to the rest, it loses value and importance and ultimately ceases to function. In the same manner, science and literature are connected to a much grander "tree" of knowledge, and they should not be subjected to truncation or separation from the whole.

The message in "Oración" is clear: while science and literature are both important to intellectual growth, they must exist together for the betterment of the individual's education.[6] More importantly, there is a natural connection between the two, as the cold, hard facts of science are balanced with the elegance and eloquence of literature. For a Spanish society stuck in its traditional views and aging educational structure, Jovellanos's suggestion of unity in educational disciplines provides a new and fresh perspective to Spanish education, and more importantly, a possible solution to the problems raised by Feijoo in the previous decades.

**Conclusions**

In many ways Benito Feijoo and Gaspar Jovellanos served as pioneers of intellectual thought during the eighteenth century. The two were arguably the most notable figures of their respective halves of the century, as both Feijoo and Jovellanos rose to become prominent Spanish thinkers. More importantly, Feijoo and Jovellanos were the first to venture into the unchartered waters of diagnosing Spain's lagging intellectual progress. Both noted the disparity between Spain and its neighboring European countries; each felt the necessity of underscoring Spain's growing issues of stagnation and intellectual backwardness, as well as proposing solutions and actively working towards a more productive and intellectual Spain. Finally, each noticed the lack of interest, knowledge, and curiosity in the scientific arena, and both made strides in solving this dilemma. However, as Spain moved into the nineteenth century, many of the same problems that Feijoo and Jovellanos noticed continued to

plague the country. Although Feijoo and Jovellanos left their indelible marks as rare, yet prominent thinkers of eighteenth-century Spain, the very same need of educational reform and the lack of progress in the sciences continued throughout the next century.

## NOTES

[1] Translations in this essay from Spanish to English are the author's own.
[2] Feijoo's *Teatro Crítico Universal* served as an encyclopedia in the Enlightenment tradition of Diderot's famous *Enciclopedie*.
[3] A wealth of information regarding Feijoo's formative years appears in Ian McClelland's *Benito Jeronimo Feijoo*.
[4] Refers to a scene from Francisco Quevedo's *La vida del buscon* (17th century) in which Poncio de Aguirre becomes a victim in an Inquisitorial *auto de fe*.
[5] Biographical information about Jovellanos, including historical perspectives about his formative years, is taken from both Chapter 1 of J. H. R. Polt's *Gaspar Melchor de Jovellanos* as well as from Juan Antonio Cabeza's *Jovellanos: el fracaso de la Ilustración*.
[6] Although other works by Jovellanos exist, this essay hones in on "Oración sobre la necesidad de unir el estudio de la literatura al de las ciencias," because it is emblematic of an entire corpus of Jovellanos's works on the theme of Spain's intellectual stagnation.

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*In* Four Quartets*, T. S. Eliot implicitly critiques a basic assumption of modernity: that human happiness consists in the alleviation of suffering through scientific progress. In contrast, Eliot invites the modern human to embrace life as purgatorial and endure suffering in order to be refined. This close reading of* East Coker *IV connects Eliot's poetry with his prose criticism to excavate Eliot's critique of modernist notions of progress.*

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# Advancing Progressively Backwards: From Progress to Purgatory in T. S. Eliot's *East Coker* IV

Courtney Micksch

In both his pre-conversion and post-conversion poetry, T. S. Eliot offers a trenchant critique of various aspects of modernity. *Four Quartets*, the most monumental of Eliot's post-conversion poems, focuses this critique in specifically philosophical and theological ways. In particular, *East Coker* IV challenges the ethos of the modern faith in science and progress. In opposition to the sanguine belief in inevitable human progress through science that is characteristic of modernity, Eliot posits mortal life as a purgatorial existence inevitably bound to suffering which, nevertheless, remains potentially redemptive. *East Coker* IV is particularly illuminating on this theme in its brief lyrical analysis of the movement from a misdirected faith in progress to the necessity of a purgatorial existence. Following an introductory overview of *East Coker* IV, this essay will offer a detailed explication of the poem in order to elucidate particular aspects of the purgative world Eliot envisions. Throughout this explication I will demonstrate that Eliot's discussion of sin is also an indictment of the values of the modern ethos. Finally, I shall conclude with an analysis of the formal poetical properties of *East Coker* IV, with a view toward the implications of its form.

The thrust of my argument is that a world ordered by progress implies the goal and possibility of a world free from suffering. Thus, by implication, if suffering were to be eradicated, happiness would ensue.

In contrast, Eliot argues that instead of viewing the world through the lens of progress, humans must conceive of the world as purgatorial. The world, due to sin, is inherently bound to suffering. Therefore, the desire to abolish suffering is in vain and misconstrues the nature of reality. For Eliot, happiness is found in the redemption of suffering through purgation for the sake of transformation.

### ***East Coker* IV**

Eliot's poetic technique in *East Coker* IV is the lyric, which includes the seventeenth-century device of a metaphysical conceit. By use of complex metaphor, built up in pieces over several stanzas, Eliot suggests a comparison between medical practice and the human condition. *East Coker* IV is a diagnosis of the human condition. The illness that Eliot persistently refers to throughout this section is the fallen state of the world and humanity due to sin—Adam's curse. The pervasiveness of sin leads to a world permeated with suffering and pain, as indicated by the need for a surgeon, nurse, and hospital. These three medical terms take on expressly Christian meanings according to the conceit. The hospital is the whole earth; every person and every creature is subject to sin and in need of the cure. Furthermore, Christ comes as the surgeon and provides the only cure for the illness of sin, just as the surgeon in the medical world fixes the physical ailments. The nurse who cares for the patient undergoing the cure is the Church. However, rather than making the patient comfortable, the Church's care serves as a reminder of humanity's sinful condition: "Whose constant care is not to please / But to remind of our and Adam's curse." The Church is an opposing voice that declares the truth of sin and inescapable suffering within a comfort-seeking world. The crux of Eliot's assessment is the paradoxical statement "that, to be restored, our sickness must grow worse." The surgeon's cure is not the relief from suffering that the world desires or expects. Instead, the cure is found through suffering. Suffering in a sinful world is a purgative experience that refines one into communion with God. Christ is the only means through which this continual purgative death and resurrection is possible. Thus, we die, burn, and endure through the sustenance provided by the surgeon, Christ—the Eucharist. Because of sin, humanity believes that it is sound and can remedy its ailment by its own means. However, participation in the sacrament of the Eucharist proves to be the only means of understanding, and thus enduring, life. Through a proper conception of the illness of the human

condition—cured paradoxically through Christ in suffering, recalled to mind by the Church, and endured by means of the Eucharist—the patient finds healing.

In order to see how Eliot's poetry critiques modernity and offers the solution of purgative existence, it proves fruitful to look at section IV of *East Coker* stanza by stanza.

I.

The wounded surgeon plies the steel
That questions the distempered part;
Beneath the bleeding hands we feel
The sharp compassion of the healer's art
Resolving the enigma of the fever chart.[1]

In this first stanza, Eliot makes the claim that the world is suffering from an illness. Medically speaking, something is awry; there is a "distempered part" and record of a "fever chart." The nature of this illness (sin) cannot be fully discerned within the context of the first stanza. However, Eliot's word choice elucidates defining characteristics of the illness. The word "distempered," for instance, is pregnant with meaning. According to the *Oxford English Dictionary*, to be distempered is to be disordered both physically and mentally. Physically, a distempered body is diseased. Psychologically, the distempered mind, involving the brain, fancy, feeling, and action, leads one to be insane, disordered, deranged and distracted.[2] Eliot makes use of the image of a fever, which not only affects the body physically, rendering it weak and subject to intermittent chills and hot flashes, but also affects the mind. The mind is unable to concentrate, think, discern, or understand properly. Eliot suggests the illness from which we are suffering is an illness of wrong ordering.

In light of this type of illness, it is essential to understand what sort of surgeon is necessary to cure the disease. That the surgeon is one who himself has suffered is confirmed when Eliot writes, "the *wounded* surgeon plies the steel." There are hints already in the first stanza that this wounded surgeon is Christ, and this identification becomes clear as the poem progresses and is more explicitly Christian. For instance, the healer's hands are bleeding, just as Christ's hands are pierced with nails during his crucifixion. This wounded Christ is the only cure for the world's disordered love. Yet the nature of the cure is, paradoxically,

painful: "beneath the bleeding hands we feel / the sharp compassion of the healer's art." Eliot emphasizes that in order to be healed, one must endure pain. Since Christ himself lived, suffered, and died as a human amidst a sinful world, human pain is not too great. Any pain and suffering one must endure *can* be endured, for Christ has effectively lived as humans must.

The sickness Eliot has diagnosed is not without hope of a cure. This hope is indicated by the line: "resolving the enigma of the fever chart." The nature of the healer in this poem does not conform to modern conceptions of what constitutes a cure. In this conceit, the healer does not resolve the *fever*, but instead, the healer resolves the *enigma* of the fever chart. This choice of words implies that the healer does not eliminate the sickness, though he does bring some sort of cure. Furthermore, the word "enigma" connotes a mystery to the sickness. The nature of the illness and its effects on humanity are neither easily recognized nor discerned, foreshadowing the need for a constant and clarifying reminder—which appears as the Church in the following stanza.

This first stanza also offers a slight critique of the modern ethos, which will become more apparent as the poem progresses. The use of a scientific and medical conceit emphasizes Eliot's discomfort with science. In the final line of this stanza, Eliot states that Christ, the surgeon, resolves "the *enigma* of the fever chart." Eliot's use of language, particularly the word "enigma," stands in stark contrast to the goals of Enlightenment thinkers and scientific progress. Science seeks to disenchant the world by reducing reality to facts, thus resolving any mystery. For believers in scientific progress, a mystery is only something that has not yet been scrutinized by science, but its facts can and will be revealed. An enigma of a fever chart, then, makes a scientific positivist highly uncomfortable. According to scientific standards, the surgeon should resolve the fever; there should be no mystery if the surgeon is a good surgeon. In the poem, the surgeon only resolves the enigma; the fever still exists, and all the medicine provided by the progress of science cannot resolve that. Ultimately, Eliot proposes an anti-modern conception of healing which emphasizes mystery over reduction to facts.

Furthermore, Eliot's particular word choice expresses an uneasiness with faith in progress and technology. The language of this section evokes two different perspectives of understanding the world. The words "art" and "chart," which appear in successive lines, illuminate the contrast between the poetic and technological conceptions of real-

ity presented in the poem. These words, grouped by rhyme, force the reader to consider them together, thus highlighting the contrast. A chart suggests measurements, formulas, and data—all scientific references. In contrast, art cannot be reduced to these strict formulations. Art connotes ambiguity, beauty, and ultimately, transcendence. Thus, the technological and scientific sound of words such as "steel" and "fever chart" is contrasted against "art" and "enigma" which evoke mystery. According to the language of the former, the world is seen as a technological machine whose good is ordered toward progress, whereas through the latter poetic language, Eliot points the reader toward the inherent mystery and paradox of the world. Eliot's use of paradox is not only antimodern in its irreducibility, but also in its transcendence of the temporal world. The numerous paradoxes that occur throughout *East Coker* IV demonstrate the ultimate spiritual understanding of reality that Eliot establishes—one that is fundamentally opposed to modern notions of progress.

II.

Our only health is the disease
If we obey the dying nurse
Whose constant care is not to please
But to remind of our, and Adam's curse,
And that, to be restored, our sickness must grow worse.

In this second stanza Eliot offers an explicit definition of the illness. The world is suffering from Adam's curse, which is sin. Sin is the condition of the whole world; all of humanity participates in sin, for it is "*our*, and Adam's curse." The disordered nature of the illness from the previous stanza is illuminated within the context of sin. Eliot's understanding of sin (as the illness) is grounded in an Augustinian model. For Augustine, sin is wrongly ordered love—defective love, excessive love, or insufficient love. Eliot's choice of adjective, a *distempered* illness, and further, his use of an emotive type of illness, a fever, reinforces this Augustinian understanding of sin. The mind, feelings, fancies, and the like are disordered according to Eliot's description of the sickness. As humans we choose to act, think, and feel in particular ways based upon the ordering of our loves. In a sinful world, this ordering is askew. To be

a healthy human, one must *learn* to love the proper things to the appropriate degree. To love properly, there must first be a recognition of sin, so that one may reorder one's loves. As Dominic Manganiello explains in *T. S. Eliot and Dante*, Eliot's understanding of sin implies that the "recognition of sin is the beginning of a new political as well as spiritual life."[3] The Augustinian conception of sin Eliot utilizes makes necessary the Church, which serves as a reminder of sin.

For Eliot, the modern glorification of scientific progress is a grave instance of disordered love. Eliot writes in his essay "The Idea of a Christian Society" that, "For a long enough time we have believed in nothing but the values arising in a mechanized, commercialized, urbanized way of life: it would be as well for us to face the permanent conditions upon which God allows us to live upon this planet."[4] Here Eliot explicitly states in prose what the poetry of *Four Quartets* implies—modern conceptions of the good life prove inadequate because of their failure to acknowledge God. Such faith in the ability of science is excessive love of secondary goods. This excessive love turns science into an idol. Although science and progress are not bad in and of themselves, the degree to which modern society depends upon its progress to alleviate pain is excessive. Technological advancements can be more efficient and at times highly beneficial, but the cost of resolute faith in technology outweighs its benefits. Technology has begun to replace human work; this change is perceived as a good thing because the machine is praised as more accurate and insusceptible to error. However, this innovation means that our world is controlled by cold, sterile machinery instead of the warmth of another human being. Modern society rejects the Christian God and replaces it with the god of science and progress. Throughout *East Coker* IV, Eliot invites the reader to transcend temporal notions of progress and enter into the spiritual reality of the one true love, God.

Understanding that the illness is disordered love (the Augustinian conception of sin) elucidates the nature of the cure. Eliot asserts the paradoxical claim that "Our only health is the disease." Because of "Adam's curse," we live in a fallen and diseased world, and sin cannot be eradicated. Thus, suffering is the persistent reality of the temporal order, and all of creation and all creatures are subject to it. However, this reality becomes "our only health" because if we can see this truth, we will understand the nature of our restoration. So long as one is deceived into believing that all is well, there will be no impetus for correction. The re-

minder of sin, which is our cure, serves to point us toward the transcendent reality of God's love. Through this paradoxical assertion, the human recognizes the need for something transcendent. Acknowledgment that suffering cannot be eradicated necessitates either transcendence or submission to despair. Eliot argues that a Christian understanding of suffering offers the necessary hope through transcendence.

The contrast between the spiritual world Eliot envisions and the modern world is illustrated through his inversion of health and disease. The notion of progress is inherently bound to the idea that things can, and should, be better. Particularly, if enough thought and research were pursued, the cure for suffering could be discovered. The very word "enlightenment" connotes the idea that more knowledge means better life. The goals of modernity ignore the fundamental reality of sin in the world. It does not take a Christian perspective to acknowledge pain in this world, but it does take a Christian understanding, like Eliot's, to make sense of the suffering. Despite the ways in which Enlightenment projects of science have proven successful, pain continues to persist. Even if technology can achieve the suppression of one case of suffering, this alleviation only brings forth a new, different, and sometimes more perverse suffering. The suffering of the modern age is not fear of imminent death or disease, but rather the loss of an identity, the loss of humaneness, and a disproportionate love of technology.

The Church's role as nurse in proclaiming the spiritual reality that underpins the temporal order becomes essential to the cure. The Church is the agent of reminder. Contrary to the ordinary role of medical nurses, Eliot explicitly states that the Church does not exist to ensure comfort: "whose constant care is not to please." Within a literal hospital, the nurse is the one who is constantly concerned about the patient's comfort and ease. If anything is to be done to make the stay easier for the patient, it is the role of the nurse to ensure its implementation. However, Eliot inverts the definitions of health and disease in this stanza, and thus the function of the nurse is also inverted. The surgeon, Christ, has inaugurated the cure in this world of suffering by enduring his own suffering. Therefore, the Church must be the constant, unyielding voice that speaks this truth in a world unwilling to listen.

Modern society rejects the Church in part because it stands in stark contrast to many modern values. Particularly, the Church contests the view that human systems will be able to eradicate sin from the world. The desire to end suffering is a desire to deny the existence of sin, for

suffering is ultimately the result of sin. Any modern attempt to end or explain away sin misconstrues the nature of reality. The role of the Church is to remind the world of its curse of sin, something people do not like to hear. The contrast that Eliot makes between comforter (the ordinary role of the nurse) and reminder (the Christian role of the Church as nurse) serves to emphasize the pain which living in the reality of the cure causes. The Church proclaims the illness of sin because only through the acknowledgment of this reality can the human respond properly through a purgative life, as will be seen in greater depth in stanza IV.

Eliot describes the nurse as dying because the Church represents the corporate death that all individuals must endure. However, the further implication of the dying Church is that the post-Enlightenment modern world is a religion-less culture. This culture is particularly perverse because it denies faith in God, while creating gods of idols. In the modern world, this perversity is especially true of the idol of progress. Eliot emphasizes the implications of such faith in progress in another section from "Choruses from 'the Rock:'"

> men both deny gods and worship gods, professing
> first Reason,
> And then Money, and Power, and what they call
> Life, or Race, or Dialect.
> The Church disowned, the tower overthrown, the
> bells upturned, what have we to do
> But stand with empty hands and palms turned up-
> wards
> In an age which advances progressively backwards?[5]

Humanity has replaced God with any number of idols, including reason and money, which are imagined to ensure the advancement of progress. Again, this view of the world as temporal existence is contrasted against the overthrown Church, which transcends the temporal and thus transforms it. Eliot asserts the futility of these endeavors quite poignantly when he states that we can only "stand with empty hands and palms turns upwards / In an age which advances progressively backwards." This progress ultimately yields empty hands; there is nothing to show for it. The regrettable paradox of progress is that *modern man only advances progressively backwards*.

III.

The whole earth is our hospital
Endowed by the ruined millionaire,
Wherein, if we do well, we shall
Die of the absolute paternal care
That will not leave us, but prevents us everywhere.

Until this point in *East Coker* IV, Eliot has been asserting the fallen nature of the world, but has avoided despair by suggesting that the cure of this diseased world is found in endurance through suffering. The third stanza plays a pivotal role in asserting that God's love underpins the world. God, who is love, is the implicit reality that orders the universe.

Eliot again insists upon the universality of the sinful condition. The hospital, the place of healing, is the "the whole earth." The hospital does not cure by controlling and eliminating the suffering of the patient as a literal hospital does. Rather, for Eliot, the hospital embraces suffering and becomes a place of death: "Wherein, if we do well, we shall / Die." However, this death is of a particular kind. One dies in order that one may be reborn and redeemed. For Eliot to call the earth "our hospital" is to suggest that all of creation and all creatures must undergo this cure in order to be redeemed.

Though it is apparent that Christ is the surgeon and the Church is the nurse, it is less clear who the ruined millionaire is. In *Word Unheard*, Harry Blamires suggests that there are potentially three different interpretations.[6] The ruined millionaire could be Adam, who was endowed with the riches of heaven on earth in the Garden of Eden and spoiled temporal paradise through sin.[7] Adam, therefore, is ruined insofar as he is bankrupt. Another interpretation is that the ruined millionaire is God, "who poured out his resources on our behalf."[8] The third possibility (and perhaps most congruent) is Christ, for Christ who was enthroned in heaven, emptied himself, took on human flesh, and gave up everything for the sake of humanity. What is consistent throughout the interpretations is that the hospital we inhabit was once rich and has now been ruined due to sin. The hope in this state is revealed by a higher reality toward which we strive—a reality that is not ruined. True reality is good, and sinful reality is ruined, but sinful reality can be restored according to the higher reality. Sin and suffering persist, but God's love is before

us always. Of these three interpretations, Christ as the ruined millionaire seems to be the best because Adam only represents the necessary death and suffering due to sin. If the world were endowed by Adam, there would be little room for hope. In contrast, Christ represents death and redemption, the complete order that Eliot expresses in this poem. Christ's life is the best example of how to live amidst a suffering and sinful world. Christ ultimately died so that he could be reborn through the resurrection. Therefore, Christ demonstrates how to be human—one lives to die and be resurrected to new life continually.

This death is expressed more fully when Eliot writes, "Wherein, if we do well, we shall / Die of the absolute paternal care / that does not leave us, but prevents us everywhere." God, the Father from whom the Son proceeds, is the paternal care. His care is expressed through the Son, Jesus Christ, who has redeemed humanity and creation. The love that moves the world, complete within the Trinity and made understandable through Christ is that which "does not leave us, but prevents us everywhere." Eliot's use of the word "prevent" is significant. Originally, the word Eliot chose was "torments," which would read: "that does not leave us, but torments us everywhere." However, in the final published form of the original pamphlet, Eliot changed it to read "prevents us." As Helen Gardner states, this change "softens the harsh paradox of an 'absolute paternal care' that 'torments.'"[9] In order to understand what Eliot is affirming in this stanza, one must note that Eliot uses the word "prevent" in its pre-modern sense. "Prevent" means "to come before," as used in the *Book of Common Prayer* which states, "Prevent us, O Lord, in all our doings with thy most gracious favour, and further us with thy continual help."[10] Those unfamiliar with this definition of the word prevent may, as Gardner suggests, read the passage as "thwarting." It could be that "Eliot intended the word to carry both meanings: of God's 'prevenient care' and of paternal thwarting of a child's willfulness and folly."[11] The important aspect of this passage is that God permeates existence. God is before all and in all and through all. God is everywhere; he does not leave us.

IV.

The chill ascends from feet to knees,
The fever sings in mental wires,
If to be warmed, then I must freeze

And quake in frigid purgatorial fires
Of which the flame is roses, and the smoke is briars.

In this fourth stanza, Eliot articulates the nature of the paradoxical cure through another paradox—a life of purgatory. It is perhaps worth mentioning that Eliot conceived of hell and purgatory according to a Dantesque interpretation, that is, "Hell is not a place but a *state*."[12] Eliot's assertion demonstrates his gravity in calling modernity "hell" and life "purgatory." Eliot does not merely use the terms to denote a fictional or after-life place, but a condition or state of contemporary society. Ultimately, Eliot argues that the human is to treat the suffering of this world as the state of purgation, in order to be refined.

The paradoxes that have appeared throughout *East Coker* IV—that the cure is sickness, death is life, the millionaire is ruined, the healer is wounded, the fever is chill, and finally, that the fires are frigid—all come to the fore in this stanza. The culmination of these paradoxes is that purgatory is the ultimate paradoxical reality of temporal existence. The doctrine of purgatory insists that suffering is something to be joyful about. In and through suffering the human is redeemed and refined. In contrast to this paradoxical understanding of the world, modern man would seek to reduce the paradox to facts.

Eliot's conception of purgatory stands within a tradition quite familiar to Eliot—that of Dante's *Divine Comedy*. Eliot is clearly alluding to Dante's poetical articulation of paradise in this stanza, particularly in the description of heaven as a rose: "In the form of a white and lucent rose."[13] The fire of purgatory is consummated in heaven, or as Eliot puts it, "the flame is roses." For Dante, purgatory only makes sense in light of the higher reality of paradise. Purgatory exists in the *Divine Comedy* as preparation for saved souls to enter into paradise. Intrinsic to purgatory is hope for a future glory, that of heaven. In contrast, hell is characterized by its lack of hope. In Canto III of *Inferno*, the inscription on the gates of hell states, "Abandon all hope you who enter here."[14] Therefore, for Eliot to describe the cure of this world as purgatory is to suggest that there is hope for something higher, an ultimate reality of paradise. One can choose death through *submission to sin* and thus be consumed by the fire of hell, or one can choose death as *purgation of sin* and be consumed by the refining fire of purgatory. Eliot elucidates his understanding of hell: "Certainly I have borrowed lines from [Dante], in attempt to reproduce, or rather to arouse in the reader's mind the

memory, or some Dantesque scene, and thus establish the relationship between the medieval inferno and modern life."[15] A lack of hope in the temporal world confines this life to a hellish existence, one that experiences suffering without hope for transformation, as seen in Eliot's pre-conversion works such as "Gerontion," *The Waste Land*, and "The Hollow Men."

Purgatory is ordered toward a final good, which is to be found in the ultimate reality of God. Suffering is an occasion to order oneself toward the love of God and requires a particular type of response from the human. The suffering is not futile; it is the necessary and meaningful condition through which one is prepared for paradise. Eliot writes not only that purgatory finds completion in paradise, but also that the suffering of purgatory is painful—"the smoke is briars." The briars are an intrinsic part of the beautiful rose in the same way that suffering is intrinsic to the enjoyment of heaven. The two must be understood together, for the briars are meaningless and ugly if not attached to the flower of the rose. Furthermore, the flower cannot exist without the stem and the briars. Thus purgation, briars, is consummated in paradise, the rose—both necessary components to happiness as fulfillment.

In order to conceive of the world as purgative, one must understand reality in a Christian way. In the essay "The Idea of a Christian Society," Eliot emphasizes the need for a Christian worldview to counter the modern ethos. He writes, "[T]he only hopeful course for a society which would thrive and continue in creative activity in the arts of civilization, is to become Christian. That prospect involves, at least, discipline, inconvenience and discomfort: but here as hereafter *the alternative to hell is purgatory*."[16] Eliot's description of a purgative society involves characteristics that the modern notion of progress would seek to eliminate–namely, inconvenience and discomfort. The kind of society Eliot envisions, one that continues to be creative and does not submit to the sterility of technology and progress, must necessarily be purgative. If this world is not purgatory, it is hell. Understanding that the world is ordered by God's love and suffering is meaningful because it enables the modern man to choose purgatory over hell.

V.

The dripping blood our only drink,
The bloody flesh our only food:

> In spite of which we like to think
> That we are sound, substantial flesh and blood—
> Again, in spite of that, we call this Friday good.

If stanza IV is Eliot's description of how one is to respond to a world of suffering, stanza V offers sustenance for persevering in this world. Eliot consummates *East Coker* IV with a description of the Eucharist and the human's absolute need for it in this life. He begins by explicitly stating that the body of Christ and the blood of Christ (the Eucharist) are "*our only*" food and drink. There is nothing else which the human can consume that will provide the type of nourishment essential to living well. The Eucharist must be our sustenance because it encompasses recognition of sin, a reminder of the crucifixion, and the blood and body of our Savior. Thus, the Eucharist is at one time the illness, the nurse, and the surgeon fused in a manner that enables perseverance in a world of suffering. The Church is essential for the Eucharist, for one is offered the body and blood of Christ by means of the Church. Therefore, part of the Church's role as reminder is to feed the congregation with the Eucharist, a constant reminder of the life, death, and resurrection of Christ. Eliot understands the Eucharist sacramentally; therefore, when the human partakes of the body and blood of Christ, it is a grace-infused act. Eliot reemphasizes the insufficient nature of humanity to resolve the troubles of this world. It is only through the sustenance offered by Christ that redemption is possible.

However, as Eliot points out, because humanity is sinful and lives in a fallen world, the human will wrongly think that "we are sound, substantial flesh and blood." The key to this line is the word "sound." Eliot is not commenting on the body as distinct from the soul in this passage. He acknowledges the value of the body as substantial flesh and blood in affirming the goodness of creation; however, humanity sinfully insists that it is *sound*, or self-sufficient. The contrast Eliot draws is that the Christian must recognize the human need for something beyond the self. He writes, "In spite of which we like to think / that we are sound, substantial flesh and blood." It is clear that "In spite of" indicates that though humanity may think it is sound, it is not. "The whole earth is our hospital" for a reason; the fallen world is suffering from a serious illness, and an outside agent is necessary for healing. As Eliot expressed in the first stanza, that healer is the surgeon Christ. Therefore, a constant reminder of Christ and the flesh and blood of Christ provide the daily

cure. The human is only sound insofar as he or she is sound in Christ; therefore, the human must participate in the sacrament of Christ—the Eucharist.

The word "sound" demonstrates Eliot's criticism of a characteristic of modernity—the modern rejection of transcendence. The lines, "In spite of which we like to think / That we are *sound*, substantial flesh and blood," articulate the modern assumption that humans are sufficient in themselves (emphasis added). The modern rejection of transcendence is an implicit belief in the power of humanity. Man believes that human knowledge and power provide the sustenance necessary to perpetuate life. Thus, the sustenance of the modern ethos is science and technology. This food is consumed in order to achieve progress, but the modern consumes and consumes through progress and is never satiated. As was stated previously, any alleviation of suffering which progress brings will only create new and different kinds of suffering. Man tries to secure "soundness" through medical advancements, technology to ensure comfort, and science to reduce the world to comprehensible matter, but none of this fulfills the human or leads to true happiness. Faith in progress is an illusion. For Eliot, it is only an appeal to the transcendent through faith in Christ and the consumption of the Eucharist that secures happiness—not because it rids the world of suffering, but because it enables humanity to endure the suffering.

Eliot was clear about the pain involved in living a purgatorial existence. Purgatory requires continual death to self, the world, and God. Fire burns: Eliot does not try to evade the necessary suffering called for in living a purgative life. However, Eliot does not expect the human to endure the pain alone. Christ, the one who himself suffered ("Beneath the bleeding hands we feel / The sharp compassion of the healer's art"), has gone before and set the example of a purgatorial life. Thus, the role of the Eucharist is a reenactment of the work of Christ, our healer. The Eucharist is a transcendent reality made immanent to the human being. It is a manifestation of the manner in which the human needs to approach the world in which sin and suffering are pervasive. The transcendent reality of God must order the purgation of this sick world.

Eliot espouses an explicitly Christian definition of goodness that conforms to the Eucharist. Goodness is inextricably bound to Christ because Christ demonstrates what it means to be human. As is evidenced through the existence of the Eucharist, Christ did not try to evade His death. He suffered and endured and was ultimately lifted into a higher

reality. His is the consummate example of the purgative existence to which all humans must conform. The Eucharist exists in the temporal order as the continual reminder and reenactment of Christ's life. The conception of goodness expressed in this stanza demonstrates the inversion of goodness that Christianity asserts as compared with modernity. Good Friday is the day in which Christ died an innocent death. Since suffering and death are to be avoided in the modern ethos, an excruciating death is the most unmitigated evil. However, Eliot asserts the paradoxical nature of Christianity in that it calls that Friday "Good:" "Again, in spite of this, we call that Friday Good." In the face of the worldly conception that life should be free from suffering and death is defeat, Christians affirm the goodness of the Friday of Christ's death.

**Formal Properties**

The literary techniques and devices of this lyric reinforce the interpretation I have been elaborating. In this final section I will explore the importance of Eliot's use of the conceit, discuss the role of paradoxes in creating a fusion of the temporal and the transcendent, and lastly, elucidate the significance of the traditional poetic form of *East Coker* IV.

Eliot's choice of the poetic style of the conceit has implications for the meaning of *East Coker* IV. The conceit is a seventeenth-century verse style, which uses an extended metaphor that manipulates ideas in order to force the reader into a higher understanding. As A. David Moody states in his essay on *Four Quartets*, the conceit's "function is to concentrate the mind upon the meaning and to make it real, to conceive it."[17] Thus, though *East Coker* IV is a succinct poetic assertion of the reality of sin and need for redemption through Christ, the language and metaphor of the conceit also offer a targeted critique of their literal referents in modern medical practice. In Eliot's essay on the metaphysical poets he writes that in the best metaphysical poetry, "the extended comparison is used with perfect success: the idea and the simile become one."[18] *East Coker* IV achieves something of this effect. The idea of the lyric is that the world is depraved and in need of a particular cure—this idea becomes one with the literal language of the hospital. Thus, the literal vehicles of the conceit—surgeon, nurse, hospital, sickness—themselves pose a critique of this aspect of modernity. Through the conceit, Eliot deepens the implications of his poetry by using the language of metaphor to comment on the literal interpretation.

The theme of the conceit is medical practice; the implication is that the modern conception of the hospital is also a peculiar sin of modernity that Eliot debunks. When Eliot uses language of medicine and technology, he means to articulate the folly of these specific endeavors as well as of the larger belief in progress which they synecdochically represent. The critique of modernity that has run throughout *East Coker* IV—that the modern world understands pain to be evil—is particularly revealing within the medical world. The means through which modernity attempts to alleviate much pain and suffering rests within the hospital. Thus, Eliot's choice of the hospital for the conceit is not arbitrary. Eliot intentionally emphasizes the futility of medical practices to secure a fulfilling life. The same reordering that Eliot strives to articulate though the use of metaphor is necessary to reorder the telos of medical practices. Living well begins with the understanding that pain is not something to be avoided and eliminated. As was expressed throughout the conceit, the elimination of suffering is a futile goal, as suffering cannot be eliminated. Further, suffering is a form of purgation, which prepares the individual for the glory of God. Therefore, medical advances that are aimed toward the wrong end ultimately prove futile as well. Thus, though Eliot employs the use of medical terms to express a truth about reality metaphorically, his literal language constitutes a critique of medicine as well.

The tension caused by the form of the conceit is further amplified by Eliot's use of paradox, which is fundamental to Eliot's poetic project. *East Coker* IV is littered with paradox. Each stanza is a paradoxical assertion on the nature of reality that stands in contrast to modern understandings of the world. Eliot finds paradox to be an appropriate means of articulating his thoughts, because a paradox necessarily forces one to consider the mystery inherent in the paradox. As Moody writes in his essay on *Four Quartets*, "The paradoxes are mental ladders by which the mind ascends from a merely natural sense of life to a spiritual understanding of it. In the conceits any contradiction between a lower and a higher sense has already been solved."[19] Ultimately, these paradoxes push the reader's mind away from the temporal and raise it to a transcendent understanding of reality. Both paradox and conceit are literary tools that strengthen the tension of the poem itself, which enables Eliot to articulate seemingly contradictory truths.

Amidst the tension Eliot creates through conceit and paradox, *East Coker* IV still maintains a traditional poetic form. *East Coker* IV is

not only a seventeenth-century style metaphysical conceit, but it also uses conventional rhyme and meter, as do very few sections of *Four Quartets*. Since *East Coker* IV is an evaluation of the human condition, Eliot's use of rhyme means something significant. Ultimately, the form represents the inherent order of reality. Though paradox and mystery characterize reality, there is the deeper, more fundamental truth of God's order. The finite human is subject to paradox, but God's ultimate order provides the framework for the paradox in the same way that *East Coker* IV maintains a rhyming scheme amidst numerous paradoxes. Therefore, Eliot uses the form to articulate the transcendent reality of God's order amidst the confines of a temporal world.

Eliot's use of the metaphysical conceit is deliberately archaic in order to articulate his anti-progressivist project further. It would be easy for a modern reader to misconstrue the form in which Eliot writes. In *Time in the Poetry of T. S. Eliot*, Gish fails to appreciate the form of *East Coker* IV and therefore devalues the significance of it: "*East Coker* IV is, perhaps, the most notable lapse. Using in a crudely literal way images, which might work suggestively, it represents, for Eliot, a rare lapse in taste."[20] However, Eliot's use of a seventeenth-century device is not a lapse in originality, but rather an expression of genius by using the past to communicate to the present. The use of the forgotten, underrated metaphysical conceit is itself a statement against progress. Eliot asserts that modern concepts of progress are mistaken not only through the meaning of his words, but also through the very form. The metaphysical conceit of *East Coker* IV poignantly contests modern notions of progress by using an archaic form to convey the truth of a transcendent purgative existence.

**Conclusion**

Through his discussion of the nature of sin in *East Coker* IV, Eliot contradicts the values of modern society. Modernity, with its idols of progress, technology, medicine, and science, attempts to erase the effects of sin from the world. In other words, the telos of modern technology is to make life easier and abolish pain. Eliot's contrasting view, informed by Christian theology, is that not only is suffering inevitable because of fallen human nature, but suffering is to the benefit of humanity. Modernity cannot accommodate this concept of purgation; however, through a Christian understanding of the world, one can see the futility of modern "progress" and the redemptive value of purgation.

## NOTES

[1] All quotations from *Four Quartets* are from T. S. Eliot, *Collected Poems, Four Quartets*, pp. 175-209.
[2] "distempered, *a.*3b," *OED Online.*
[3] Dominic Manganiello, *T. S. Eliot and Dante*, 137.
[4] T. S. Eliot, "The Idea of a Christian Society," 290.
[5] *Choruses from 'the Rock'* VII, in *Collected Poems*, 164.
[6] Harry Blamires, *Word Unheard*, 68.
[7] Kenneth Kramer assumes that the "ruined millionaire" is Adam. Kramer, *Redeeming Time*, 94.
[8] Blamires, 68.
[9] Helen Gardner, *The Composition of Four Quartets*, 109.
[10] *Book of Common Prayer*, quoted in Gardner, *Composition of Four Quartets,* 109.
[11] Gardner, 109.
[12] Manganiello, 14, emphasis in original.
[13] Dante Alighieri, *Paradise*, XXXI.1.
[14] Dante Alighieri, *Inferno*, III.9.
[15] Eliot, "Dante," 220.
[16] Eliot, "The Idea of a Christian Society," 282, emphasis added.
[17] Moody, "*Four Quartets*: Music, Word, Meaning, and Value," 149.
[18] Eliot, "The Metaphysical Poets," 61.
[19] Moody, 149.
[20] Gish, 107.

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*Sir Isaac Newton's mathematical mechanics transformed the scientific universe of the seventeenth century; however, Newton's theories also contained metaphysical and theological innovations which were equally revolutionary. The widespread acceptance of Newtonian physics ensured that these metaphysical and theological presuppositions would continue to influence the development of modern science thereafter.*

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# Engineering Babel: Law, Mathematics, and God in Newton's Physics

Matthew Newell

Sir Isaac Newton radically altered the scientific understanding of physical mechanics by applying a mathematical construct to the universe. From the perspective of modern physics, many of Newton's physical equations, as he presents them, are not entirely accurate when compared with more contemporary theories; nevertheless, they are maintained and taught as extraordinarily useful approximations of current mathematical models. More importantly, he is almost universally lauded as one of the first to "rescue" the sciences decisively from the realm of indemonstrable metaphysics. Such an understanding is half true. Newton's physics did indeed drive a wedge between the sciences on the one hand and metaphysics and theology on the other. However, to say without qualification that Newton separated the sciences from the unverifiable "occult qualities" of metaphysics is to reveal a gross misunderstanding of his work. Newton made extraordinary metaphysical and theological claims; some are blatant, some deeply hidden within his theorems—perhaps deliberately hidden. This research will examine the fabric of Newton's mathematical physics, engaging its crucial elements on a physical, metaphysical, and theological level. Such a comprehensive review reveals a decisive truth directly applicable to modern science: no examination of physical reality is free from metaphysical and theological considerations. Though one may exert incredible effort to do so, it is impossible to abstract the sciences from these considerations. On the contrary, the belief that such abstraction is possible itself contains a specific metaphysical and theological judgment on reality. The more forcibly one tries to cast these aside, the tighter one binds one's own chains to this judgment.

**The Laws of Nature and the System of the World**

> Behold the pattern of the heavens, and the balances
> of the divine structure;
> Behold Jove's calculation and the laws
> That the creator of all things, while he was setting
> the beginnings of the world,
> would not violate.
>
> —Edmund Halley, Ode on This Splendid Ornament

> We must needs see that God is truly just, in seeing how He gives to all existing things what is proper to the condition of each; and preserves the nature of each one in the order and with the powers that properly belong to it.
>
> —Pseudo-Dionysius, On the Divine Names, in Thomas Aquinas, Summa Theologiae, Q. 21 Art. 1

An understanding of Newton's system of the world requires an understanding of the framework of Aristotelian causality that Newton is rejecting. Aristotle's metaphysics proposes four causes: material, formal, efficient, and final. The material cause and formal cause both describe the nature of a thing: the formal cause describes what a thing is, or what makes it intelligible; the material cause describes out of what a thing is made, or what its raw materials are (Baldner 135). The efficient cause describes that which changes a thing and produces an effect: an agent acting as a source of change. The final cause describes the *telos* of the change: the end, goal, and purpose of an activity.

This understanding of causality was not toppled by Newton overnight. Upon the Western rediscovery of Aristotle's works in the Middle Ages, Aristotelian metaphysics swept through the European universities. It was embraced by St. Thomas Aquinas and many scholastic thinkers. Yet two centuries before Newton, Galileo had already delivered strong attacks against Aristotle, and later Francis Bacon declared, regarding formal and final causality, that "the Final is a long way from being useful; in fact it actually distorts the sciences except in the case of human actions. Discovery of Form is regarded as hopeless" (Bacon 102). Ba-

con's comments illustrate the mindset that Newton inherited. Formal and final causality might still have a place in metaphysics or ethics, but natural science is indifferent to them. In this mindset, the only useful causes that operate in the realm of natural philosophy are the material and efficient.

This more limited conception of causality actually transforms the way the material and efficient causes are themselves understood. Because the material cause describes the stuff of which an object is made, a science which focuses only upon the material cause will naturally tend to place more importance on the parts rather than the whole. Thus, it strongly encourages various forms of atomism and proposes a metaphysic suggesting that the complete understanding of a thing's nature depends only upon understanding the thing's most minute parts. Furthermore, the elimination of final causality from the realm of science ostensibly suggests an intention to divide the "more controversial, less empirical" matters of faith from the "purely rational, highly empirical" matters of science. However, making this division actually suggests that science is unqualified to comment upon any purpose in the natural order. If there is any such purpose, it is external to nature. To use a physical example, gone is the idea that an object moves in order to fulfill the telos inherent in its own nature. Instead, the object moves because it must conform to external laws of nature.

Before proceeding to discuss Newton's conception of the laws of nature, it is important to understand first that laws of nature were understood by Aristotle differently from how they were understood by Newton. Aristotle did not object to articulating laws of nature. For instance, he proposed that the lighter elements, air and fire, tended to rise, and the heavier elements, water and earth, to fall and conglomerate (*Physica* IV. 1, 208b 8-12). Yet this very example reveals a key difference in the metaphysical presuppositions of Aristotle and Newton. The lighter elements rise because of properties inherent in their own nature, not because of some external principle imposed upon them, like the separation of relative densities. It is because of the nature of the heavier elements that they fall, not because of an external law, such as gravity. Aristotle would not object to a definition of laws of nature as generalizations that account for observable phenomena. But such an explanation would always take into account the individual natures of the objects involved. An external principle, like gravity, that acts indiscriminately on objects without regard to their natures would never be a sufficient explanation

*per se*; such an explanation would fail to account for final causality. Even if an object moved in accordance with an external law such as gravity, it would move according to the telos inherent in its nature. To move in such a fashion would be an aspect of the object's own nature.

Furthermore, Newton's framework of external law was not universally accepted even in his own era. His contemporary Leibniz wanted to maintain Newton's mechanistic explanation of nature while preserving the final causality that it ejects: "the laws of motion and nature have been established, not with absolute necessity, but from the will of a wise cause, not from a pure exercise of will, but from the fitness of things" (Leibniz 319). The denial of a pure exercise of will is an attack upon Newton's theological voluntarism, which exalts the absolute freedom of God's will beyond any potential constraint from mercy, justice, or love. It is more fitting to discuss Newton's voluntarism at length with his conception of space and motion. However, Leibniz goes further to demonstrate an objection not to external laws of nature governed by efficient causes *per se*, but only to the elimination of an object's internal striving to fulfill its own nature governed by final causality.

Leibniz saw something lacking in Newton's purely mechanical universe. Even though will is preserved in Newton through voluntarism, it is functionally eliminated in nature. This assertion should not be read in caricature; such a view of volition in nature does not imply that little atoms are gritting their teeth as they try to move and form chemical bonds. It does imply that their motions and actions are governed by their nature, and the source of this nature is God. This is what it means for nature to possess volition according to Leibniz: an object "cooperates" with its nature which is given and directed by God. In contrast, there are effectively only two volitional agents in the Newtonian universe: God and man. The universe is governed in an absolute sense by the unadulterated will of God, and by man in a subordinate sense. In both senses, there is only *active* volition. God can affect the world with his will either by direct intervention or by imposing laws upon nature to which nature must submit in a mechanistic fashion. There is no possibility of a divine telos in nature which is actualized by the unfolding and realization of an object's nature; rather, God must always be actively at work in the universe in order to achieve his ends in nature. Again, this theological point becomes crucial in Newton's concept of motion, which shall be discussed later.

This concept of external laws that govern the operation of nature

has been the normative schema of modern science since Newton. He can be considered the father of this paradigm because his mathematical articulation of natural phenomena was the first to meet widespread empirical success. In Newton's mature thought, mathematical truth claims are given absolute primacy. In an early unpublished essay on hydrostatics titled *De Gravitatione Et Aequipondio Fluidorum*, Newton seems to suggest that mathematics is merely a very useful model when truth happens to correspond to its formulae: "to the extent that [this science] appertains to the mathematical sciences, it is reasonable that I largely abstract it from physical considerations" (*Gravitatione* 121). However, the primacy of mathematics in Newton's mature thought is apparent in the very title of his greatest work: *Philosophiae Naturalis Principia Mathematica*, or Mathematical Principles of Natural Philosophy. It is clear that this title is meant to echo the title of a book by Rene Descartes, a powerful influence on Newton, entitled *Principia Philosophiae* (Cohen 43). Newton's theories were aimed to combat Descartes' explanations, and the title clearly demonstrates that Newton wanted to emphasize the mathematical nature of the principles that he was presenting.

The *Principia* itself follows a macroscopic pattern that proceeds from the purely mathematical to the physical. In *De Gravitatione*, Newton takes care to begin with a physical statement and only to abstract it mathematically to the degree that a mathematical construct is appropriate. In contrast, the *Principia* begins with a mathematical construct and moves later to demonstrate how it coincides with physical reality. In this fashion, mathematics is not only a privileged expression of truth but a rhetorical device designed to preempt early criticism. As a rhetorical device, it allows Newton first to present a very simple system and then subsequently add levels of complexity, and second to withhold controversial physical explanations for his mathematical conclusions until his schema is firmly established (Cohen 149). Newton articulates this design in section 11 of Book 1: "For here we are concerned with mathematics; and therefore, putting aside any debates concerning physics, we are using familiar language so as to be more easily understood by mathematical readers" (*Principia* 561). Naturally, Newton would not follow this pattern if he were not convinced that this mathematical construct is entirely coincident with physical reality.

Yet here the deadly "occult qualities" return—unverifiable metaphysical claims which are supposedly antithetical to natural science. No matter how convinced Newton was that mathematics has a unique and

privileged claim to truth, he knew that every claim to truth in the physical realm of natural philosophy must be supported by empirical evidence or, at the very least, by a plausible hypothesis which might be tested at a later date. And despite Newton's delay in discussing the correlation of mathematics to physics until Book 3 of the *Principia*, his opponents were not deceived and appropriately attacked his physics where they thought that the correlation was illusory or feigned. The most obvious instance of this criticism is gravity itself. Almost every one of Newton's scientific contemporaries was wary of any physical theory that proposed a mysterious attractive force, many of them adhering on a cosmological level to the Cartesian vortices which were then dominating mechanics (Cohen 154-55). It is no surprise then that in *De Gravitatione* Newton spends two-thirds of the essay in a digression attacking Descartes. In a late essay, Leibniz censured Newton and universal gravitation, writing, "it pleases others to return to *occult qualities* or to *Scholastic faculties*, but since those crude philosophers and physicians see that those terms are in bad repute, changing the name, they call them forces" (Leibniz 313, emphasis in original). Other scientists like Huygens agreed with Leibniz: "[Newtonian] attraction is not explainable by any of the principles of Mechanics, or of the rules of motion" (qtd. in Cohen 153). Newton's contemporaries were not prepared to assign special privilege to a mathematics which could not justify its physical foundation.

Though Newton himself was absolutely convinced that his mathematical theory of universal gravitation explained physical reality, even he was unable to find any physical explanation of it. The last paragraph of the General Scholium introduces some of Newton's speculations about how gravity might operate physically: "a few things could now be added concerning a certain very subtle spirit pervading gross bodies and lying hidden in them; by its force and actions, the particles of bodies attract one another at very small distances and cohere when they become contiguous" (*Principia* 943-44). These concluding speculations imply that Newton was passionately searching for a physical basis of gravity in his private thought, here supposing a sort of modified aether.[1] Even Newton is hesitant to declare that there is a force with an ability to act that is unmitigated by any distance. Yet ultimately, he will not indulge those who will not accept his mathematics as is. This is his famous *hypotheses non fingo*: "Thus far I have explained the phenomena of the heavens and of our sea by the force of gravity, but I have not yet assigned a cause to gravity . . . . I have not as yet been able to deduce

from phenomena the reason for these properties of gravity, and I do not *feign* hypotheses" (943, emphasis added). This famous statement reveals both Newton's frustration at the lack of physical evidence for his theory and his scorn for his scientific colleagues who drew ranks to oppose him. How then, in the face of such intense opposition, did the theory of universal gravitation come to be accepted universally as descriptive of physical reality?

The answer is crucial: Newton's mathematical formulae gave its wielder godlike predictive power over the phenomena of the natural world. To state it bluntly, the equations were accepted because they *worked*, and dramatically so. Francis Bacon paved the way for this utility in the *Novum Organum* with his famous *maxim ipsa scientia potestas est*, "knowledge itself is power," claiming that the goal of the sciences is to bend nature to mankind's will: "they are the noblest and most perfect works, the finished products of every art, for as the chief thing is that nature should contribute to human affairs and human advantage" (150). Newton himself hoped that the successful utility of his equations would discourage dissenting voices. On this issue the noted Newton scholar and translator I. Bernard Cohen writes: "I see no reason to believe that Newton was not sincere in his hope that his readers would go along with him and follow his development of mathematical principles, which would prove to be so powerful that their use in natural philosophy could not be denied" (154). Newton's publishing liaison and friend Edmund Halley wrote a prefatory ode to Newton that appears in all three editions of the *Principia*. This ode captures with mellifluous language the excitement of the epoch as it begins to realize the power of these equations:

> The things that so often vexed the minds of the
> ancient philosophers
> And fruitlessly disturb the schools with noisy debate
> We see right before our eyes, since mathematics
> drives away the cloud.
> Error and doubt no longer encumber us with mist;
> For the keenness of a sublime intelligence has made
> it possible for us to enter
> The dwellings of the gods above and to climb the
> heights of heaven.
>
> (*Principia* 379-80)

Such optimism was contagious, and Newton's physics ultimately was accepted unreservedly. In modern physics, the mathematical apparatus is given a highly privileged position. Of course, physics does not discard experimental verification, and theoretical physics stands in a complicated relationship with experimental physics. The point is that in modern physics, a theory will be accepted if its equations produce accurate mathematical data, even if the physical reality that corresponds to the mechanism of the equations remains unknown. On an ironic note, it may be telling that if a man were to ask the entire array of physicists in the three centuries since Newton for a causal explanation of gravity, he would be met with resounding silence.

Independent of any physical basis for gravitation, however, Newton would have understood gravity as merely one important instance of the laws of nature through which God governs the world. Appropriately, Voltaire gives a triumphant response on Newton's behalf to the Cartesian mechanistic naysayers: "the cause of attraction is among the *Arcana* of the Almighty; it is in the bosom of God" (qtd. in Cohen 154). It is then clear that an absolutely essential cornerstone of Newton's thought consists of external laws of nature. The specifically external character of these laws arises out of a reduction of Aristotle's four causes to only the material and efficient, and in a reinterpretation in the meaning of these two causes. Further, these laws are of an unmistakably mathematical character, and they are valued because of their predictive power. This mathematical understanding of law indeed contains theological implications in the role of God as Lawgiver to the universe.[2] It is now appropriate, then, to turn to Newton's construct of space and motion, and to examine the Lawgiver God of the Newtonian universe.

**God, Space, and Motion**

> The supreme God is an eternal, infinite, and absolutely perfect being; but a being, however perfect, without dominion is not the Lord God.
>
> —Isaac Newton, *Principia Mathematica*, General Scholium

> Here, power failed for this high phantasy;
> But, now, as a smooth wheel—without any jars—
> My will and my desire turned evenly

> Through Love that moves the sun and other stars.
> —Dante Alighieri, *The Divine Comedy*, *Paradiso*,
> Canto 33 (trans. Peter Dale)[3]

The concepts of space, time, and motion are intimately linked in Newtonian thought and share crucial metaphysical and theological implications. Let us then begin where Newton does: with axiomatic definitions. Newton opens both *De Gravitatione* and the *Principia* with a presentation of definitions, a step he considers crucial: "the foundations from which this science may be demonstrated are either definitions of certain words; or axioms and postulates denied by none" (*Gravitatione* 122). The pith is, of course, whether these axioms are as true and as self-evident as Newton presents them. Newton treats these axioms most candidly in *De Gravitatione*, although they are presented virtually unchanged in the definitions of the *Principia*. Thus he begins:

> Def. 1. Place is a part of space which something fills evenly.
> Def. 2. Body is that which fills place.
> Def. 3. Rest is remaining in the same place.
> Def. 4. Motion is change of place.
> (*Gravitatione* 122)

It is staggering how much is assumed in these four introductory statements.

With the first definition, Newton in a sentence destroys the Aristotelian concept of place. This too is a consequence of the elimination of formal and final causality: Newtonian physics cannot comment upon an object's proper place based upon either the kind of thing it is or the purpose of the thing. Newton defines "place" as the physical coordinates in absolute space that an object occupies. (Absolute space will be discussed presently; let it be sufficient for now that absolute space describes an object's position independent of any reference to nearby objects.) Under this definition, physics is indifferent to an object's place. In contrast, recall that Aristotelian principles can never be completely abstracted from an object's nature. For example, in describing the place of a carrot seed, Newtonian physics would be content to locate where the carrot is in space, independent of other objects. Aristotelian physics would, besides locating the carrot in space, comment that the proper

place of a carrot seed is underground in good soil, first because the proper place for the kind of thing that a carrot is, is underground; second because underground is where the carrot can grow and actualize its nature. If the carrot is violently removed from its proper place, say hung up on a clothesline, the carrot will evidence that fact by dying.[4]

Again, this comparison should not be read in caricature. Physicists do not need to ask whether a carrot is in its proper place to determine how long it would take it to fall from the top of a building to the ground. However, the Newtonian definition does not so much assert a conditionally useful definition for a mathematical construct as make a normative claim about the relationship of matter to space. This reduction of place to a mere synonym of space occupied makes physics impotent to comment on an object's proper place or its proper motion.

Further analysis of place leads to the second definition: body as that which fills place. The definition he gives of "body" defines it merely in relation to place, which as has been shown is reducible to space. Though this definition appears to suggest that body also is ultimately reducible to space, Newton emphatically asserts that although space is present in every body, space is neither equivalent to body nor merely accidental to body. The opposing Cartesian notion is that body and space are identical, because every other attribute of bodies (e.g. color, weight, hardness) can be abstracted from body as accidents (*Gravitatione* 131). Newton articulates his characteristic idea of absolute space as a response to Descartes:

> For since the distinction of substances into thinking and extended entities…is the principal foundation of Cartesian philosophy, which he contends to be even better known than mathematical demonstrations: I consider it most important to overthrow that philosophy as regards extension, in order to lay truer foundations of the mechanical sciences. (131)

Here Newton presents yet another example of the privileged truth status of mathematics as he prepares to introduce his conception of absolute space through extension.[5]

Strictly speaking, extension for Newton is neither substance nor accident. "Substance" and "accident" are Aristotelian terms. Substance is something that exists independently, like a lemon. Accident is some-

thing that can only inhere in some subject, like "yellow." Yellow has no independent existence. There can only be yellow carrots, yellow crayons, and the like. Newton considers both of these to be insufficient descriptors for extension: "Perhaps now it may be expected that I should define extension as substance or accident or else nothing at all. But by no means, for it has its own manner of existence which fits neither substances nor accidents" (131-32). Extension is not accident, because even though every body possesses extension, one can clearly imagine empty space, space without any bodies in it. Nor is it substance, because "it is not absolute in itself, but is as it were an emanent [*sic*] effect of God, or a disposition of all being" (132). In other words, space cannot be truly considered an independently existing entity because it is an emanating effect of God. "Emanent" here refers to issuing or flowing forth from God; thus, space is not substance because it does not independently exist *stricto senso*.[6] Furthermore, space is not substance because it is intimately related to being.

Newton elaborates on this last point with an enumeration of spatial attributes with blatantly theological character:

> Space is a disposition of being *qua* being. No being exists or can exist which is not related to space in some way [*even God*] . . . and the same may be asserted of duration: for certainly both are dispositions of being or attributes according to which we denominate quantitatively the presence and duration of any existing individual thing. (136)

This remarkable assertion comes close to claiming that God is absolute space. Newton is asserting that space and time are *essential* dispositions of being: there is *no being at all* that is free from them.[7] Newton further articulates this point in the *Principia*: "He endures always and is present everywhere, and by existing always and everywhere he constitutes duration and space. Since each and every particle of space is *always*, and each and every indivisible moment of duration is *everywhere*, certainly the maker and lord of all things will not be *never* or *nowhere*" (941, emphasis original). Since space has a necessary correlation to existence, God's omnipresence is intimately linked with his being. Furthermore, the attributes of absolute space appear to be remarkably similar to the traditional attributes of God: Space extends infinitely in all directions;

it is motionless (or *unmoved*); it is eternal in duration; it is immutable in essence. Newton would not want to say that God himself is *subservient* to space and time, as they are his emanant coeternal effects. Nevertheless there appears to be a circularity within this reasoning: it appears to make the existence of God, and indeed being itself, dependent upon one of his effects. By making such a claim, Newton has already destroyed God's transcendence. Making space an emanant effect of God makes God immanent in relation to the world.

This relationship leads to the capstone of Newton's theology of absolute space: the *sensorium dei*. The term literally means "sense organ of God," and appears in the General Scholium of the *Principia* and in the *Opticks*. Leibniz objected to the literal meaning of this phrase: "Sir Isaac Newton says that space is an organ which God makes use of to perceive things by. But if God stands in need of an organ to perceive things by, it will follow that they do not depend altogether on him" (320). It is likely that Newton did not intend the term quite so literally—he uses the term to emphasize that absolute space is the *apparatus* through which God interacts with the world. As Newton says, "[God] is not eternity and infinity, but eternal and infinite; he is not duration and space, but he endures and is present" (*Principia* 941). Since God is necessarily related to space, all of God's actions upon the world occur at some place and at some time. Space as *sensorium* further cements Newton's theological voluntarism: it is the arena in which God as Absolute Ruler holds sway over the universe.

With Newton's conception of absolute space firmly established, we now return to the latter two of Newton's four axioms to explore the relationship of motion to God's governance. Newton defines "rest" as remaining in the same place and motion as change of place. Once again, Newton's axiomatic definitions depart radically from Aristotelian motion. A definition of Aristotelian motion is difficult to articulate because it is a complex concept that is intimately related to being and to the two aspects of substance, matter and form. The key is the interplay between what *is* and what *can be*: motion is the change of an object that is in potentiality to actuality. There are four main types of motion: local motion, a change from one place to another; alteration, a change in quality; increase and decrease, a change in quantity; and generation and corruption, a radical change in an object's being (Baldner 135). The crucial element in this definition of motion is *change*. Aristotle's Peripatetic school understood motion for substances as the opposite of *stasis*

(Shields 407-08): a ball rolling across the floor, the fading of a sheet of paper from white to yellow, the growth of a seed into a plant, and the conception of a child are all instances of motion. Indeed, Aristotle believed that an object at rest was in its natural state of motion. A seed in its proper place, the ground, is at rest when it is moving to actualize the telos of its nature: growing into a plant.

In contrast, Newton's axioms reduce all motion to local motion. Again, this distinction is not made simply for the sake of a mathematical construct, but a genuine assertion about the types of change upon which science is qualified to comment. One can indeed use Newton's physics to study the local motion of dropping a plant off a building without troubling about whether the motion is proper—yet it matters greatly for the plant. Newton's motion is not a transformation; it is a *condition*, a state: "Because a body is indifferent to its motion, this motion can play no part in telling us anything significant about the nature of the body in question and, moreover, motion plays no part in a body's fulfillment in a telos" (Oliver 170). For Newton, a body does not change when it moves. His physics drives proper motion and qualitative transformation out of the realm of knowledge.

Finally, Newton's axioms understand rest and local motion to differ only quantitatively. The only difference between rest and motion is a relationship between the space occupied and the time elapsed (here again is the importance of absolute space). Rest is simply motion reduced to zero: "Motion and rest are quantitatively different instances of the same state" (Oliver 168). As a result, the phenomenon of motion itself is remarkably uninteresting in the Newtonian universe. In other words, there is nothing in motion to study. Physics may concern itself with motion's particular variables: position in absolute space, rate with respect to absolute time, and in particular the motive force responsible for the motion. The phenomenon of motion itself, however, is in every instance the same.

This last point regarding force completes this analysis of Newtonian physics. Force is essential to the Newtonian universe as the means by which objects are moved: "Force is the causal principle of motion and rest" (*Gravitatione* 148). Newton distinguishes in the *Principia* between internal *inherent* force and external *impressed* force: "Inherent force of matter is the power of resisting by which every body, so far as it is able, perseveres in its state either of resting or of moving uniformly straight forward . . . Impressed force is the action exerted on a body

to change its state either of resting or of moving uniformly straight forward" (405). These distinctions of force firmly establish their authority in Newton's First Law: "Every body perseveres in its state of being at rest or of moving uniformly straight forward, except insofar as it is compelled to change its state by forces impressed" (416). Force acts with the authority of the inviolable laws of nature.[8] Moreover, this definition shows how, in Newtonian terms, a state of physical rest (no local motion) is indiscernible from a state of uniform motion. The only time one tangibly experiences motion is during acceleration, the application of force.

Force is the *potestas* by which God moves the universe—this is the moment when theological voluntarism comes to the front. God exercises his sovereign will over the universe through the laws of nature, specifically the laws of motion. Newton analogizes the way God moves the universe to the way human beings move their bodies, purely through an act of will: "God may appear (to our innermost consciousness) to have created the world solely by the act of will, just as we move our bodies by an act of will alone" (*Gravitatione* 141). With respect to this aspect of man's power, Newton further states: "Nor can we move bodies in any way but only in accord with those laws which God has imposed on us . . . [and] we do not move our [own] bodies by our own independent power but through laws imposed on us by God" (141-42). Because will is the means by which God acts upon the world, Newton places extreme importance upon God's sovereignty. Voluntarism is how Newton tries to escape blatant immanence: "He rules all things, not as the world soul but as the lord of all. And because of his dominion he is called Lord God *Pantokrator* . . . a being, however perfect, without dominion is not the Lord God" (*Principia* 940-41). In order to preserve the absolute and unchanging quality of the laws of nature, Newton must have his God continually preserve them with the might of his absolute authority. Such, then, is God's relationship to the world: he exercises his will through the laws of nature by the apparatus of the *sensorium dei*. It is extraordinarily telling to note that for all of Newton's theology, he not once in the entire *Principia* mentions God's love.

**Newton and Modern Science: Concluding Remarks**

Newton is often hailed as the first natural philosopher to reduce the sciences to the empirical, with the understood normative judgment that this reduction is an improvement. One does not need to deny the

significant accomplishments of Newton's mathematical mechanics. Besides any practical accomplishments in engineering, it brought the mind closer to understanding the truth of motion, one of the most fundamental facets of physical reality. However, Newton committed himself to a staggering metaphysical and theological reality—a reality of reduction that ultimately divorced physics from much of what is meaningful in human existence. It is too difficult to trace here the complete course of metaphysical and theological development in physics from Newton to contemporary science. However, it is clear that at least one trend is a manifestly growing chasm between what belongs to the physical sciences and what belongs to metaphysics and theology. The separation that Newton latently introduced was apparently not thorough enough. Yet modern science, instead of removing the metaphysics and theology in Newton's mechanistic physics, has merely concealed them. A growing trend among contemporary scientists is to move the traditional attributes of God from God to the very laws of nature. Paul Davies reveals this in his characterization of contemporary perspectives on the origin of life:

> They are saying, in effect, that the laws of the universe are cunningly contrived to coax life into being against the raw odds; that the mathematical principles of physics, in their elegant simplicity, somehow know about life and its vast complexity. . . . It means that the laws of the universe have engineered their own comprehension. (Davies 246)

This example reveals the inescapable consequence of this study of Newton—modern science has not weeded out the metaphysical and theological implications of Newton's mechanistic universe simply by abstracting it even further into the mathematical realm and proofreading every paper for any vestige of the non-empirical. The external laws of nature still stand. The notion of mathematics as a privileged expression of truth still stands. Motion as an indifferent state still stands. Modern science is committed to a metaphysical position in its evaluation of the universe whether it acknowledges the fact or not, and it is foolishness to suppose that an impoverished understanding of metaphysical reality could produce anything other than an impoverished understanding of God.

## NOTES

[1] Aether is one of Aristotle's five elements, a heavenly element distinguished from the terrestrial four: earth, air, water, and fire. Aether is retained in later physical theories up to and including Newton; it is always supposed to be a very rarified sort of matter which acts as a medium in which physical objects may interact with each other at distance. Specifics, however, vary from theory to theory.

[2] The privilege which Newton gives to mathematical forms of knowing, even when physical explanation is lacking, potentially suggests a powerful theological judgment on God's own mode of knowing. Galileo, for example, famously asserted that humans are able to know mathematical truths with absolute certainty: humans know the truths of mathematics *exactly as God knows them*. The difference between human knowledge and divine knowledge is that God understands *all reality* with the same sort of absolute certainty with which humans understand the truths of mathematics. Newton's exaltation of mathematical theory suggests that he might view mathematics in a similar fashion, as a privileged expression of God's mode of knowing; unfortunately, any direct comment by Newton on this issue is elusive.

[3] I am indebted to Rev. Dr. Simon Oliver for this particular selection of Dante, which he quotes at the beginning of *Philosophy, God and Motion*. Its glorious melding of God, love, and a rich, metaphysically and theologically charged conception of motion evokes precisely the tensions which I intend to resolve in this section.

[4] I am indebted to Dr. Michael Hanby (class lecture, 9 Oct. 2006) for this particularly colorful explanation of Aristotelian place.

[5] Newton uses the term *extension* interchangeably in his writing; in a more substantial sense, he uses it to refer to absolute space itself, and in a more accidental sense to refer to that property of bodies by which they occupy space.

[6] In making this point, Newton reveals another key difference between himself and Aristotle, or at least Aristotle as articulated by Thomas Aquinas. Newton seems not to consider space a substance because God must continually supply its existence. This conception is quite distant from an understanding of God as Being itself, who gives different degrees of being to *all* substances, and this is what constitutes their natures, their essences. God's continual sustenance of the gift of being is not a problem for their status as substances.

[7] Again, the presentation of the argument is significant. Newton appears to think of God as "just another being," albeit the most perfect one, rather than as Being itself, who "exists" in a manner unlike any other being.

[8] Newton's definition of "inherent force" as "the power of resisting by which every body, so far as it is able, preserves" seems certainly to be an illustrative metaphor. Internal force should not be equated with the more Peripatetic view articulated earlier, that objects strive to actualize their own nature.

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