Convocation 2015: Mathematics, a Gateway to Philosophy and the Search for Truth

St. John's College in Annapolis opened the 2015-16 academic year on August 26 with Convocation, the annual ceremony rich with traditions. Nearly 120 freshmen participated in a procession from McDowell Hall to Francis Scott Key auditorium, where each student is called on the stage to meet President Christopher B. Nelson. Students sign the college's register and receive an Ancient Greek lexicon as a gift from the college.

Here is the 2015 Convocation address:

Welcome to St. John's College. To our returning students, faculty and staff, welcome back. To our freshmen and their families, we are very happy to have you joining us.

In the next few days, you freshmen will begin working your way through a book that I think, more than any other, serves as an exemplar of guidance in an activity we try to undertake in all of our classes, especially our tutorials. I speak of Euclid's*Elements*. I imagine that there may be one or two among you who do not now love mathematics and may even be a little intimidated by it. Let me put it another way: there may be among you a few who have no idea how much you will come to love the study of mathematics and more particularly this first and most beautiful book of geometry and proportions.

If so, you would not be the first. As we sit in the Francis Scott Key Auditorium of Mellon Hall, I am reminded of the difficulty Paul Mellon had with his Mathematics Tutorial in the autumn of his freshman year, 1940. Paul Mellon, philanthropist and heir to the Mellon Bank Fortune, was the single most important financial supporter of the College from the early years of the New Program until 1964 and later through his estate. Mellon had started as a mature student, having degrees from both Yale and Cambridge. He had done well in plane geometry, memorizing theorems at Choate and receiving a perfect score on his College Boards. But he was flabbergasted and embarrassed that he could not do his demonstrations of Euclid's propositions at the blackboard at St. John's. As things progressed from bad to worse, Mellon wrote to his psychiatrist, explaining the problem. He received a letter in reply, part of which says this:

"It is an asinine prejudice that mathematics has anything to do with the training of the mind. It has as little to do with the mind as music, which also doesn't train the mind in the case of one who isn't musical. . . . So, I think you waste your time absolutely when you try to study mathematics. Mathematics is a hellish and perfectly useless torture for somebody who hasn't the gift in that way, as it is the most boring nonsense to be forced to learn to play an instrument when one isn't musical. Tell your professors that their psychological knowledge is a bit weak."

The letter was signed: "I remain yours cordially, Carl Jung."

And you wonder why no book by Carl Jung is on our Program in Annapolis!

I may have taken a risk in telling you this story, lest you mistakenly believe that Jung provides a legitimate excuse to treat one of the most beautiful books ever written as useless torture.

I got lucky some 55 years ago to have discovered Euclid. I was in the seventh grade, in an age when all girls took Home Economics (a semester each of Cooking and Sewing) and all boys took a semester of Shop followed by one in Mechanical Drawing. For Christmas, between semesters, my parents gave me a drawing board, ruler, compass, T-Square, various plastic triangles, proper pencils, and a pad of drawing paper. I went straight to work, doing all the exercises that awaited me in the coming semester, finishing them before the class had barely started, so completely had I fallen for the beauty of precise draftsmanship.

When I had finished the textbook exercises, I went to my father to see if he could find something more for me to draw. He understood my need and, like any good alumnus of St. John's College, pulled down from his bookshelf a 1941 edition of Book I of Euclid's *Elements*. I am pretty certain that I skipped the definitions, postulates and common notions, something I do NOT recommend to our freshmen.

So, starting with Proposition 1: “On a finite straight line to construct an equilateral triangle,” I drew a line and two circles whose centers were the end points of the straight line and whose distance to the circles’ circumference was that very same straight line. “Oh, good,” I thought, as I took out my ruler and compass, drew the figures shown in the proof, and constructed the equilateral triangle, labeling everything according to the drawing in the Euclid text. I then proceeded to do the same for all 48 propositions of Book I.

Back to Dad: “Now what?” I asked. “Book II?”

Instead, he asked me to set aside my ruler, compass, and other tools, and try Proposition 1 again without them, freehand. Well, I went about it as carefully as I could, drawing the line and circles, labeling the points and intersections. But what I drew frankly did not look like an equilateral triangle. Mine was a pretty lopsided figure. I said I just couldn’t do it freehand, as I was no good at drawing perfect circles.

My father then asked me to go through the proof out loud and show him where I had gone wrong. And so I did, and I proved that my triangle was indeed an equilateral triangle, notwithstanding how lopsided it looked. This was my first “Eureka!” moment in mathematics, when I came to realize that the drawings were merely imperfect images of the perfect figures Euclid was constructing in his geometry, using definitions, postulates, and common notions as his tools instead of my draftsman’s mechanical tools, which had their own imperfections too. Euclid’s proof was true and would hold up, however poorly I had drawn my figures.

Now I went more slowly through Book I a second time, figuring out how those elementary building blocks so simply laid out in the first three pages could prove all of the propositions in the book. I was now freed of my mechanical tools and able to work in a new world made real by the application of a handful of definitions, a few rules of construction or postulates of the imagination, and a few axioms of logic. I was getting behind the appearances of the geometrical drawings to understand better the reality of the objects of geometry: a point that has no part, a line without breadth, neither of which could be seen with the eye or drawn with the pencil; circles and triangles that could only be imperfectly represented in my drawings, even those made with the finest of mechanical tools. I could dwell in a world lodged firmly in the imagination, somehow more perfect, more “real,” than the one I usually inhabited with my family and friends, a world filled with objects that have color, dimension and shape, a world we experience in time and space.

I soon began to wonder what it might mean to have discovered an imaginary world that could explain the number, size, shape, and movement of bodies in our earthly world and in the heavens above. Sometime later I would ask the question a little differently: What would it mean to understand that all of mathematics is a metaphorical language used to describe the relationships among things in the physical world that I inhabited during most of my waking hours? How were we to judge how far we could draw out that metaphor? And I came back to the question as to which world was the more real and what was the proper relationship between the two. From these questions sprang my love of mathematics and mathematical physics.

Another thing in the *Elements* caught my imagination some years later. It was contained in Euclid's five postulates. I asked how it was that I could draw the line on which I would construct the equilateral triangle of Proposition 1. It was not by virtue of having the definition of a line as "breadthless length". That definition did not seem to bring the line into being or to tell me that I had the power to make it so. How was I to take the very first step in the very first proof? Well, there it was: "Let it be postulated: (1) To draw a straight line from any point to any point," Euclid seemed to describe an activity and give the reader the power to engage in that activity. We know that we cannot really draw a line with breadthless length, but Euclid was giving us both permission and power to do so. Euclid was a teacher of geometry, helping us see in time and space how to go about understanding these geometrical objects of imagination in relation to one another. The construction could be understood best by the unfolding, or revealing, of its nature in a series of steps taken in succession over time.

And then years later, a senior colleague of mine helped me understand the complex grammatical construction of the postulates in the original Greek, that they did not direct an activity so much as reveal what these timeless figures were as though they were coming into being in time. To give you an idea of what I mean, let me compare two different translations of another famous text.

The sophomores are reading *Genesis* just now. Consider the differences in these two translations of the opening of that book:

The King James version reads: "In the Beginning, God created the heaven and the earth. And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters. And God said, Let there be light; and there was light."

Another version from the Tanakh, translated by the Jewish Publication Society, reads: "When God began to create the heaven and earth—the earth being unformed and void, with darkness over the surface of the deep and a wind from God sweeping over the water—God said. 'Let there be light'; and there was light.'"

In the first translation, it is as though God created the heavens and earth out of nothing. So, the imperative "Let there be light!" seems to suggest a kind of supernatural calling into being. In the second, it is as though God was bringing order to chaos over time. It allows us better to imagine "Let there be light!" as a revealing of what that order might be, a revealing of what had been dark. The second translation contains an ambiguity between the revelation of what is and the activity of calling it into being. I think Euclid is doing something like this in his postulates, revealing what these timeless objects of the imagination are even as we observe them coming into being.

We students of Euclid are thus engaged in an activity that appears to be bringing geometrical objects into being even as we are recognizing them for what they already are, timeless and permanent, already possessing all the properties that will be revealed over the course of the remainder of the book. When we go to the board in our mathematics tutorial and repeat the steps in Euclid's propositions, we are engaged in a journey of the imagination to reflect on the origin, nature, and elements of a line, a circle, a construction, a proof. The truth of the proposition is revealed to us through the application of reason to our imagination.

This activity, trying to understand origins and elements, lies at the heart of much of what we do in our study together at St. John's. But we cannot always start at the beginning as Euclid did, with first principles and elements, building up our understanding from there. Nonetheless, because we have had this experience with Euclid, we imagine that we can work our way back from the appearances, from the phenomena, from the opinions of mankind, to the origins, principles, and elements that underlie what we are hearing, reading, and seeing with our senses, to uncover their origins, foundations, and elements. If we cannot start at the beginning, we must instead work to recover that beginning and uncover the elements of the object of our study.

This is why we sometimes call a St. John's education "elemental" or "elementary," not because what we seek to learn is simple or easy to grasp, but because we are always looking to uncover what lies beneath or behind what we think we are seeing. We are seeking to find a truth about the object of our study, just as we have come to see the truth of a Euclidian proposition through the application of both the intellect and the imagination to the original, elementary building blocks.

Achilles rages. Why is he angry? What lies behind his rage? Is it natural or not? Good or bad? Is it justified? Can it be controlled or not? If in the end his anger is resolved and some sense of humanity restored, how did this happen and why?

"The will of Zeus was moving toward its end." What has Zeus's will got to do with Achilles's wrath? Does that will control the fate of the warriors? Who are these gods and do they determine the outcomes of battle or do they serve as poetic metaphors for deathless forces we cannot control or comprehend?

We wish to understand what it means to be human and we want to know about the world we inhabit. What are our origins? What was in the beginning? How do we live and grow? How do we satisfy our needs? How ought we to express our love and sympathy? How become better and wiser? How use our talents to make this a better world? How ought we to treat our planet and use the resources nature has provided? We need to know something about ourselves and our world to answer these questions. We need to uncover a truth we can recognize for what it is—a helpful way-station and landing place on our way to a deeper search for an answer to a question newly raised by the answer we have just uncovered. And on it goes, delving deeper into foundations, looking for the elements of the construction we call our world.

At other colleges and universities these elements are rooted in isolated disciplines: chemistry, biology, psychology, or political science; earth science, astronomy, geology, or physics; perhaps history, theology, poetry, or music. We appreciate the need to specialize in order to get a refined understanding of any one thing. But how can you ever come to uncover the truth of a mere part of something without having some understanding of its relationship to other parts or to the whole of which it is a part?

You already have some experience of an integrated whole; for the most part, you have lived a life that has not been lived in an isolated discipline. And yet you have likely been unconscious of most of the elements and foundations of your world. We take seriously your need to be conscious in your search for an understanding of yourselves and your world, the interconnectedness between the two, their origins and elements. And we have constructed a curriculum and a way of helping you bring it to life within yourselves.

So, what has Euclid got to do with all of this? First of all, Euclid permanently refutes Carl Jung. The study of his *Elements*has everything to do with the training of the mind, exercising the imagination, using your reason, and applying it to the world you live in. His book is an exemplar of the study of elements and origins that you will be looking for in all of your study here. And lucky for you, it is only one of some 130 original works of imagination, each of which has been chosen for its capacity to help you uncover something you may recognize as a truth about yourself or your world, each of which will help you find the next question you need to ask to understand something still more fundamental in your search for answers to the many questions you have—the questions that have undoubtedly brought you to this College.

But I am not finished with Dr. Jung! Not only has mathematics got everything to do with the training of the mind, but it has everything to do with the elements of music, which is not the boring nonsense Dr. Jung claims it to be. And to prove the point, I invite all of our upper-classmen to rise and use their one common musical instrument—their voices—to welcome our freshmen to our community.

[All Rise to Sing *Sicut Cervus*]

Thank you. After the recessional, I invite everyone to join us for refreshments and conversation outside the Mitchell Gallery through the doors of Mellon Hall.

I declare the College in session this 26th day of August, 2015.

CONVOCATUM EST!