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THINK

THE LOLA STEIN INSTITUTE JOURNAL

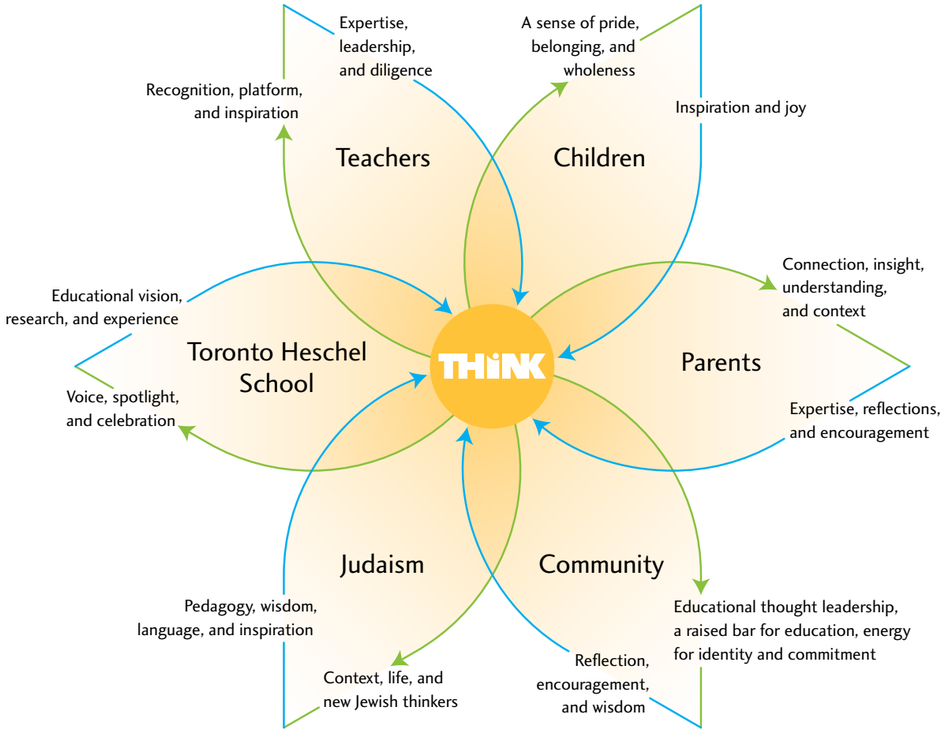
Conversation about Education, Ethics, and Our Children

SCIENCE

METHOD & WONDER: WHERE SCIENCE & JUDAISM MEET / RETURN TO THE MOON /
THE ARCHITECTURE OF THE CLASSROOM / ECO-ZIONISM /
CURIOSITY & WONDER IN EARLY YEARS / THE SCIENCE OF SOUND & SOUND OF SCIENCE

The THINK Ecosystem

This flower names what **THINK gives** to parents, the community, Judaism, The Toronto Heschel School, teachers, and children, and what **THINK receives** from them in return.



THINK THE LOLA STEIN INSTITUTE JOURNAL

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Lola Stein z"l was an early female pharmacist in South Africa, but her special talent was in hospitality and friendship. She cared for family and friends, at home and abroad, individually, uniquely, and lovingly. We honour her memory in a way that also reaches out to many.
We lovingly remember Mannie Stein z"l whose enthusiasm and support for our work with children is gratefully acknowledged.

Integrated Jewish Studies espoused by The Lola Stein Institute are delivered at The Toronto Heschel School, a Jewish day school in Toronto, Canada.

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LSI PUBLICATIONS

How children get a grip on reality depends on how they learn science.

Think Like a Scientist

To raise adults who are wise begins with children who notice and value the wonder of their world. Abraham Joshua Heschel wrote, "The beginning of awe is wonder, and the beginning of wisdom is awe."[1] In the technologically impressive society in which we live, sometimes it's tricky to remember humbly that we just don't know everything about everything. How do we bring up children who will push the limits of conventional wisdom and discover new frontiers, yet respect the process and take care en route? The answer may be to think like a scientist, even if you're a ballet dancer or teacher or…parent.

Twenty-three years ago, when we began this educational journey, we would speak about preparing children to participate in society. Learning through the arts, dedication to ecology and social justice still distinguish our brand. Immersion in the dynamic spirituality of A.J. Heschel, Judaic text, and Hebrew language remains our modus operandi. Yet there is one commitment in our work that we have yet to sing out, and so this issue of THINK celebrates our commitment to reality, to the physical world, to science.

At THINK we are stuck on reality. It's not that potential and imagination are, in any way, off limits, we love them, but everything does hang on reality. We research and develop education to prepare children for real life, and how they get a grip on reality depends on how they learn science.

We are not talking about technology, which is applied science. Computers and the like put science to useful ends. Edison's light bulb worked because Benjamin Franklin noticed that lightning was electrical; Franklin was the scientist. Antibiotics save lives because biologist Alexander Fleming observed that mould kills bacteria. Progress involves identifying a challenge, looking to nature for answers, and putting natural phenomena to work. This issue of THINK presents why and how we teach children about the physical world.

Daniel Abramson writes that children, who study the moon in Grade 1 and again in Grade 8, learn the astronomy but also absorb how powerful it is to bring new knowledge to the familiar. Shachar Leven and Nechama Drookman teach the science of sound: they predicate deep learning on systematic investigation of a topic in all its forms and behaviours, and on students who bring their whole self to the study. Lisa Rendely writes that where we learn informs what we learn: she analogizes the classroom's physical set up and organization—it's architecture—to a scientist's design and management of her lab. Sigal Cohen and Sari Herson focus on nurturing the self-regulated, inquiring mindset that is key to developing students who think like scientists and share how it can be achieved from a very young age.

In Awe and Wonder, Greg Beiles discusses why some Jewish day schools shrink from bringing science and religion together, while others, like his, find the confluence exciting and valuable. Lisa Richler describes this combustion of ideas in her Spotlight on the Grade 6 Eco Seder where students use metaphors borrowed from the Passover Seder to inspire research into environmental issues. Alumna, Liane Stein, also aligns scientific and Jewish thought; she bridges Hebrew language, Torah, with the works of Nobel Prize laureates Eric Kandel and Elie Wiesel.

In the Learning Centre, Dvora Goodman explains Eco Zionism, a schoolwide curriculum that shakes up how youngsters see the Jewish state, interweaving student enthusiasm for tending the planet with both scientific and Jewish appreciation of Israeli environmentalism. The scientific method can also be game changing in child development and parent–child relations; Jasmine Eliav revisits the evolution of how humans encounter the world and the people they love.

Apples may not fall far from the tree, but they do drop. Isaac Newton said so. Let's pay attention.

Pam

1 A.J. Heschel, *Who Is Man?* (Redwood City, CA: Stanford University Press, 1965), p. 88.

Method and Wonder

WHERE SCIENCE AND JUDAISM MEET

BY GREG BEILES

A colleague once joked that, in a Jewish day school, there are two subjects that are Holy: Math and Science. The distinction is that the Holy of Holies is Science. Meanwhile, the juxtaposition of science and religion in Jewish day schools has potential for controversy. To avoid it, a *mechitzah* (a division or separation) is generally placed between the two—and never the twain shall meet. One is taught in the morning, the other in the afternoon; assign different teachers, each expert in one field and less than so in the other.

Avoiding the complexity of how and where religion and science interact is understandable, but regrettable. Such sidestepping presents students with false dichotomies between truth and faith; it oversimplifies science, and it diminishes the grandeur of Judaism. In our work at The Toronto Heschel School, we explore the fertile terrain where science and Judaism not merely coexist but enrich one another.

The first step is to honour both science and Judaism as disciplined ways of encountering the world, not simply as sets of knowledge or sentimentally charged experiences. Core principles of the scientific approach or "scientific method" involve asking a question, for which a hypothesis is proposed, then tested. The method evolved over the millennia from Ancient Egypt, Greece, Babylonia, and India, through Islamic philosophy and science to the European Renaissance and the modern age.

Nullius in verba is the motto of the United Kingdom's academy of natural science, The Royal Society. It translates from the Latin to mean "not on the word." If you want to know the truth, don't take anyone's word for it—test it out for yourself. Sadly, what often passes for science curriculum in schools is the memorization of facts and formula, which is anathema to science itself; masters of the method, such as Aristotle and Galileo, would shake their heads.

At Heschel, we structure science education through the essential elements of the scientific method. From the earliest age, students learn how to observe real life closely and reach meaningful conclusions through experimentation. We use the world as our laboratory. They are active scientists, not passive recipients of scientific information.

To study ecosystems, students scrutinize organisms living inside one square metre of our school's yard; to study animal behaviour, they choose a dog, cat, woodpecker, or squirrel who lives in their home, backyard, or local park and formulate their understanding through patient daily observations. They learn celestial relations of the sun, earth, and moon, by stepping outside their homes at night to chart the movement of the moon; they aggregate their data, and verify or modify their discoveries in light of the evidence. To study the systems of the human body, students run races, meticulously recording and testing the correlation between their heartbeat and breathing rates. Prior to looking at diagrams and models that present the conclusions of anatomists, students make and test their own hypotheses about the relationship between the circulatory and respiratory systems.

The scientific method answers questions of "how?" It looks to causality: How does vapour rise and form into raindrops? How does light refract through those drops to make a rainbow? Science can explain how the sky can appear blue through refracted light and the physiology of the human eye. It cannot answer the question, "*Why* is the sky blue?"

Judaism addresses the "why?" It looks to questions of purpose; questions that are particular to our tradition, such as "Why do we observe the ritual of Passover?" and those that are broader, such as "Why was the world created and what is our place in it?" Like science, Judaism has a method to answer its questions. According to Rabbi A.J. Heschel, the Jewish way of thinking is rooted in a sense of awe and wonder. "Wonder rather than doubt is the root of all knowledge,"[1] he writes. It first seems that Heschel is differentiating the Jewish method from the scientific method, which is grounded in "doubt" and skepticism. However, by emphasizing the value of "wonder," he signals a critical place where Judaism and science interact. Science leads us down the path of discovery; wonder gives us a reason to go there, and stops us in our tracks at important moments along the journey.

A number of years ago, when teaching both science and Torah with my Grade 5 students, I noticed that Moshe's encounter with the burning bush contained many elements of the scientific method. When he notices a bush burning in the desert, and stops to carefully observe the strange phenomenon, he wonders, "Why is the bush not burned up?" and then tests his observations by watching closely over a period of time. He makes an analysis and arrives at a conclusion based on what he has seen.

Alongside correlation to the scientific method, two points in the encounter belong to the domain of wonder and religion. The first is when Moshe turns aside from his daily task of shepherding to contemplate this "great sight." Prior even to analysis and investigation is the moment of awe and wonder that captivates. The Hebrew word *nes*, poorly translated as "miracle," really means "a sign" of something wondrous. The Jewish concept of a created world is a world full of such "signs." It awaits human beings, naturally replete with awe and wonder, to contemplate their meaning.

The second "religious" moment comes at the end of the encounter, in the way that Moshe grasps the moral implications of his experience. The understanding comes to him literally as an "epiphany"—the voice of God—that tells Moshe to lead the people of Israel out of servitude. Later interpreters clarify that the fire represents the pain of slavery, and the permanence of the bush reveals the endurance of the people in their spirit of freedom (Midrash Shemot Rabbah 2:5). Moshe begins with awe and wonder, employs the scientific method of observation and analysis, and returns to religion to make a moral decision. I dubbed this productive integration of science and religion Moshe's Miraculous Method.

Judaism answers its questions by seeking connections between natural, historical, and sociological conditions to generate moral meaning and action. Rabbi Lord Jonathan Sacks, author of *The Great Partnership: Science, Religion, and the Search for Meaning*, puts it this way: "Science takes things apart to see how they work; religion puts things together to see what they mean."[2] Science helps us understand how an astounding variety of species exists on earth; Judaism helps us make the best choices to act responsibly and morally within the complexity of creation. A well-developed capacity for awe and wonder heightens our sensitivity to the relationships and connections required for moral reasoning.

Science—and therefore discovery—benefits when students are nurtured in the practices of awe and wonder; trained to gaze thoughtfully at a starry night and to contemplate what lives in the grasses beneath their feet. Judaism benefits when students understand that critical thinking, asking questions, and experimenting promote moral decision-making and the understanding of human purpose.

Jewish tradition regards Avraham as a great scientist, and it regards monotheism as highly correlated with reason and rationality (Bereshit Rabba 39:1). When Avraham went out to gaze at the stars in the sky, he recognized in this "great sight" a profound responsibility for future generations. We owe our children this same capacity for insight, the one that comes when science and Judaism meet on the horizon.

1 A.J. Heschel, *Who Is Man?* (Redwood City, CA: Stanford Universiry Press, 1965), p. 53.
2 Jonathan Sacks, *The Great Partnership: Science, Religion, and the Search for Meaning* (New York: Schocken Books, 2012), p. 2.

Greg Beiles is the Head of The Toronto Heschel School and the Director of The Lola Stein Institute.

קום והתהלך בארץ בתרמיל ובמקל
וודאי תפגוש בדרך שוב את ארץ ישראל

Arise and walk through the land
With your backpack and stick,
And there on your journey,
You'll rediscover the land of Israel.

Eco-Zionism

A LIGHT UNTO NATIONS

BY DVORA GOODMAN

This line comes from a classic Israeli song that was inspired by the Torah verse in Bereshit where God tells Abraham, "*Kum hithalech baaretz*" (Arise and walk in the land) (Genesis 13:17). These words set in motion a Jewish connection to the land of Israel that would endure even when Jews lived elsewhere. They were used in the nineteenth century by early Zionist thinkers for inspiration.

David Ben-Gurion, Israel's first prime minister, was well known for his commitment to developing the desert. After years of public service, he retired to Kibbutz Sde Boker in the Negev Desert. He said:

> It is in the Negev that the people of Israel will be tested—for only a united effort of a volunteering people and a planning and implementing state will accomplish the great mission of populating the wilderness and bringing it to flourish. This effort will determine the fate of the State of Israel and the standing of our people in the history of mankind.[1]

Ben-Gurion's words evoke a sense of not just walking—or being—in our land but of the collective responsibility to care for it. His sentiment reflects values that The Toronto Heschel School lives by daily with respect to prioritizing care for the natural environment. Eight summers ago, several Toronto Heschel educators visited the Negev—areas near Eilat, Kibbutz Lotan, and the Arava Institute for Environmental Studies—and observed truly exciting progress in ecologically responsible care for the land of Israel. They returned home inspired to develop a schoolwide curriculum to be called "Eco-Zionism."

Eco-Zionism would introduce students to a new way to engage with the spiritual and emotional Jewish bond to the land that is Israel. To develop the curriculum, all Heschel educators had to dive deep into learning on the topic; they studied early Zionist texts by A.D. Gordon and Martin Buber on returning to care for the land, and later writings by Israeli authors Natan Alterman and Amos Oz.

While Zionism means eternal commitment to a Jewish homeland in the land of Israel, despite struggles with political correctness and social justice trials and challenges, the school takes Zionism one step further and advocates for a homeland that is environmentally sustainable. Eco-Zionism is now a spiral curriculum for the school's annual celebration of Yom Ha'atzmaut, Israel Independence Day. Eco-Zionist learning links with grade-specific themes that students are already pursuing in class, and, instead of Yom Ha'atzmaut being a day set aside from study, it becomes a link in the chain of meaningful connections to Israel.

In education, a "*spiral curriculum* can be defined as a course of study in which students will see the same topics throughout their school career, with each encounter increasing in complexity and reinforcing previous learning."[2] At Heschel, teachers draw on wide-ranging ecological initiatives that are emerging from Israel. In Junior Kindergarten, the children are exploring the Torah story of Creation and, leading up to Yom Ha'atzmaut, as they learn about Day 5 of Creation, they study the region of the nature preserve of Ein Gedi and its animals. In Grade 2, with their ongoing study of children around the world, the students get acquainted with a school in Eilat where students are working to recover and protect the coral reefs in the Red Sea.

In Grade 6, the year's Hebrew-language studies include learning about different parts of Israel, including the Kinneret, the Dead Sea, and the Mediterranean. Their Yom Ha'atzmaut program examines Israel's unique water supply challenges and how Israeli scientists solved what should have been a water crisis.

Grade 8 at Heschel features a year-long study of human rights, which includes collaboration with peers at a Muslim school in Toronto. The Grade 8 Yom Ha'atzmaut explores how ecology is being used as a peacemaker between Israel and its neighbours. The Arava Institute for Environmental Studies is the premier environmental teaching and research program in the Middle East. Located in the heart of the Arava Desert, it educates and mentors Israelis, Jordanians, Palestinians, and North Americans to solve the region's environmental challenges collaboratively. The Grade 8 students envision environmental efforts that may simultaneously resolve critical challenges on the land, build bridges between neighbours, and manage conflict.

Israel is a world centre, a light unto nations, for environmental advances. Israeli environmentalist Alon Tal famously said, "There is no other burning social issue in Israel in which World Jewry can be more involved and should be more involved than the environment." As parents and educators, we are looking to raise children who are responsible and who care for the world they inherit. We know that their generation will be attentive to social imperatives and naturally occurring repercussions. In the mix, we want them also to feel deeply the Jewish connection to Israel, our spiritual homeland. The Eco-Zionist approach offers a path for collaboration between Jews living inside and outside of Israel.

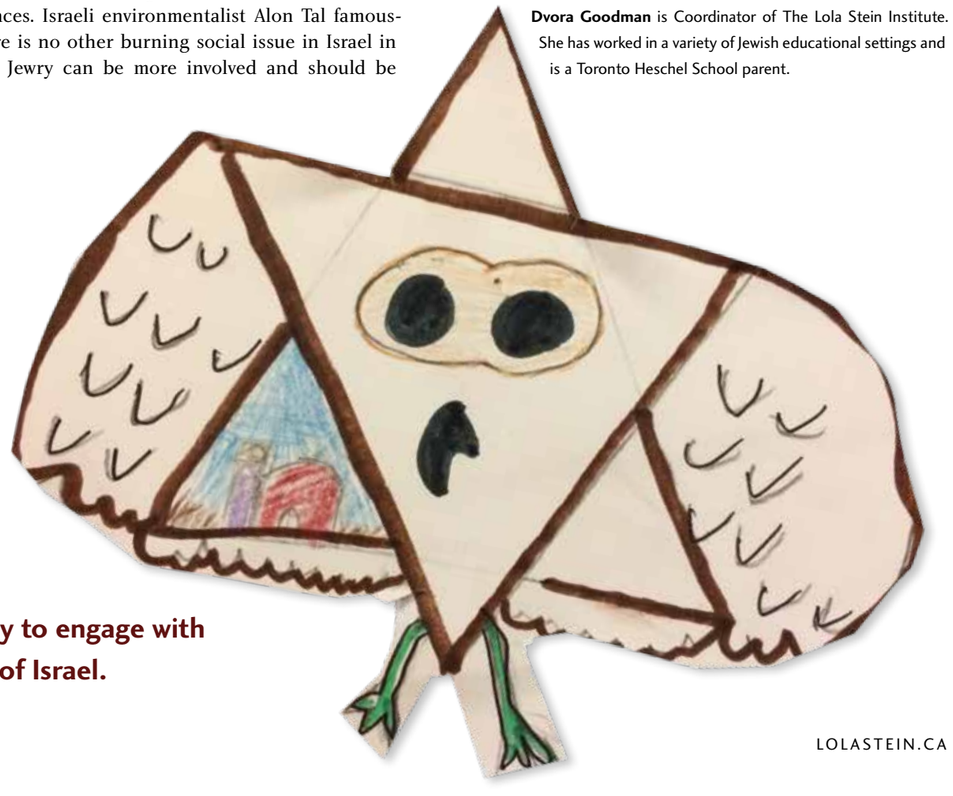
Framing Israel this way sees Toronto Heschel grads leave Jewish day school with an integrated commitment to valuing the land of Israel as well as the land of Canada. Jews have long been cognizant and proud of our contributions to the intellectual and cultural domains; in this day and age, it can be meaningful to young people to see Israel as a source of environmental leadership. How love and pride flares will always vary from generation to generation, and ours is the time for Eco-Zionism. Ben-Gurion also said, "The desert provides us with the best opportunity to begin again. This is a vital element of our renaissance in Israel. For it is in mastering nature that man learns to control himself."[3]

1 David Ben-Gurion, "The Significance of the Negev" (January 1955), *Haluza*, http://www.haluzasmartcity.org/smartcityen-inspired_by_ben_gurion_-inspired_by_ben_gurion

2 "Sprial Curriculum: Definition and Example," *Study.com*, retrieved July 10, 2018, https://study.com/academy/lesson/spiral-curriculum-definition-example.html

3 Michael Omer-Man, "This Week in History: Ben-Gurion Retires to the Negev," *The Jerusalem Post*, December 10, 2010, https://www.jpost.com/Features/In-Thespotlight/This-Week-in-History-Ben-Gurion-retires-to-the-Negev

Dvora Goodman is Coordinator of The Lola Stein Institute. She has worked in a variety of Jewish educational settings and is a Toronto Heschel School parent.



A new way to engage with the land of Israel.

Students demonstrate themes from the Seder that resonate in environmental responsibility and action.

The Grade 6 Eco Seder

LISA RICHLER

Every year at the Passover Seder, families worldwide gather around the table to recount the Jewish journey from slavery to freedom. The Haggadah narrative winds its way through themes of bitterness, resourcefulness, renewal, and community. It's an annual reminder of our heritage, and it encourages us to accept personal responsibility for our safety today and freedom for future generations. But how does one teach these concepts to 11- and 12-year-old students? How do we convince children that this matters?

In Grade 6 at Toronto Heschel, the elements of the Passover Seder receive fresh significance through correlation to environmental issues. Canadian students in 2018 expect freedom to include life in a clean, sustainable environment. In the environmentally conscious culture of today, it's not too big a jump, especially at Toronto Heschel, for students to feel personally responsible for taking care of the natural world. At the Grade 6 Eco Seder, students are heartfelt as they demonstrate to parents and friends that the themes of the Seder resonate in environmental responsibility and action.

In the months before Passover, each Grade 6 student chooses a particular step in the Seder, and relates it metaphorically or symbolically to an environmental topic that they will research. Some projects connect concretely; for example, כרפס (*karpas*, dipping and eating the greens), might inspire thoughts about the "greenness" of our food, or green spaces in the world. Others inquire into more abstract relationships; for instance, צופן (*tzafun*, the search for the hidden matzah), might inspire exploration of pollutants hiding in the environment. The students narrow down a research focus and raise questions for an independent survey that they will create and examine in the data management unit of math class.

Grade 6 students might not easily relate to the bitterness of slavery, to the hardships that B'nai Israel endured, or the resourcefulness required to survive the journey to freedom. But looking through the lens of ecology, these concepts take on new resonance. One group of Heschel students explored יחץ (*yachatz*, breaking), the part of the Seder when we break the middle matzah and put half aside for later. They explained that because B'nai Israel had to save some of their matzah for later, we also keep some of ours aside at the Seder, as the *afikoman*. The students explained that even though we are not slaves, and can live comfortably, we are responsible for saving our resources—agriculture, animals, water, food, forests—for the future. The story of B'nai Israel helps us understand that we must not take natural resources for granted.

The students also design and craft unique ceramic plates to illustrate:

1. the "step" in the Seder that they chose as their inspiration;
2. the science and ecological ethic that they explored; and
3. the four names of Pesach (Passover) that reveal the fullness of the Jewish idea of freedom: Chag HaHerut, celebrating liberation; Chag HaPesach, remembering sacrifice; Chag HaMatzot, acting flexibly in the push forward; and Chag HaAviv, noticing the rewards of spring.

What is amazing about this project is that when the students present their work to their families and school community, they demonstrate an incredible sense of agency over their findings. Simultaneous immersion in scientific research, Judaic interpretation, and community polling puts them at the centre of their own independent learning—the emergent self-confidence plus a zeal to share their discoveries and ideas are palpable. They present as experts who are explaining specific critical ecology, and they share their personal recommendations for change. This year, parents were introduced to topics ranging from the protection of endangered animals, to the hazards and benefits of forest fires, to sustainable farming.

What I love about the Eco Seder project is that it takes ephemeral concepts from the Hagaddah and brings them into the Grade 6 headspace. The students explore and experience core Jewish values. Through the Seder, they see the values at work in the world. The students are thinking like ethicists, scientists, Judaic scholars, and community participants all at the same time. It's well worth a celebration.

Lisa Richler is the parent of three Toronto Heschel School students. Formerly a teacher and writer, she is now the school's Director of Communications and Admissions.

THINK: The Lola Stein Institute Journal
extends Mazal Tov
to

Gregory S. Beiles
Director, Lola Stein Institute
Head, The Toronto Heschel School

on the successful completion of his doctoral dissertation
on the Philosophy of Religion at The University of Toronto.

The dissertation examines the parent–child relationship
as a model for teaching and learning,
in the work of Jewish philosophers,
Franz Rosenzweig and Emmanuel Levinas.

Dr. Beiles joined the school as a teacher in 1997.
He served as Director of the Junior High & Director of Curriculum
and became Head of School in 2015.

Mazal Tov!

SCIENCE

Return to the Moon

BY DANIEL ABRAMSON

Students re-encounter familiar ideas in step with their advancing abilities, each time thinking more critically about the topic.

"The best teachers are those who show you where to look, but don't tell you what to see."

—Alexandra K. Trenfor

As a kid, I loved the days at school when we had science. I remember using a battery and salt water to separate hydrogen from oxygen in a test tube of water. We tested the gasses with a burning splint. The one that made a loud pop on contact with the flame was hydrogen. In fact, the most memorable experiments involved a flame, a beep, a pop, or some moment of tremendous or surprising energy. While I did love the action and excitement of learning through these experiments, I admit that the dazzle of sparks and fire overshadowed the learning.

This "illustrative magic trick" mode of science education helped me to remember, but not to understand. Until I became a science teacher, I had never thought much about how many different ways there are to teach science. And today there are so many. I see schools and libraries offering learning in 3D printing, coding, robotics, or computer-aided design. I notice that designations such as science and Science and Environmental Studies are being replaced by terms like "STEM," an acronym for collected courses in science, technology, engineering, and mathematics, and "STEAM," which is the same mix but includes the arts and so adds the "A." These changes in offerings and nomenclature reflect shifting approaches to teaching science.

In his article "My Pedagogic Creed,"[1] John Dewey, the renowned educational theorist and psychologist, advocates that education be contextualized in the real-life experiences of learners. Because students do their learning in the world and on the playground, Dewey argues that schools are responsible to provide the skills they need to learn from those experiences; learning cannot focus on preparation for future living, but should grow from the present experiences and situations of students. This kind of thinking explains why we, at Toronto Heschel, look at the world as our laboratory. We ground our students' science education in their present real experience and the physical world around them.

Our Head of School, Dr. Greg Beiles, writes about the advantages of a spiral curriculum.

The science program is designed intentionally so that students are introduced to scientific concepts when they are young and re-engage with the ideas again as older students. They repeatedly re-encounter familiar ideas in step with their advancing abilities, each time able to think more critically about the topic. The students become comfortable in the habit to reconsider the familiar and as they grow in intellect and experience, their understanding of concepts, events, and discoveries grows wider and deeper.

Our study of astronomy is one good example. Toronto Heschel's students first consider the moon in Grade 1 when they are assigned homework to look at the night sky and record the date, time, and the shape of the moon. The young children monitor the moon nightly for a full month. They see it appear, slowly transform from a small sliver of light to a full round disc, and then gradually shrink again until, on Rosh Chodesh, the new month, there seems to be no moon at all.

As much as they are learning about the phases of the moon, the first graders are also learning patience and persistence, which are fundamental elements in scientific inquiry (among other things!). They realize that knowledge develops through attention to detail, and that scientific thinking requires us to notice the small changes and patterns that unfold over time. The youngsters are learning to think like scientists. They are gratified, for example, when their own observations explain the Jewish calendar and its lunar months. At Heschel, Early Years' science education does not hinge on the fleeting, flashy eureka moment.

Our Grade 8 students—having trained in the skill of careful observation through the Early Years, elementary grades, and Junior High—reposition their gaze back on the skies and return to astronomy for a more sophisticated investigation. Their learning about celestial objects—sun, moon, and stars—continues to unfold.

In the fall, as daylight dwindles, the Grade 8 students become proficient in using a wristwatch as a compass. They create clinometers, like those used historically in astrolabes, to measure angles and slopes so important to navigation and orientation. They also make sundials to tell time. Armed with their instruments, the students collect a body of data on the changing altitude and azimuth of the sun and moon, understanding not only the heavens but also their own place in the universe.

Rabbi Abraham Joshua Heschel hails wonder as the root of knowledge. He adds that wonder cannot be experienced when looking at reality through "the latticework of memorized knowledge." Instructive demonstrations and concise textbooks fall short because they reiterate "borrowed or inherited knowledge."[2] You won't find our students studying a solar system from a model or illustration. No textbook, illustration, or replica can match direct observation, experimentation, and primary scientific investigation into natural phenomena. The students are out in the field with telescope and notebook recording incremental changes hour-to-hour and day-by-day. They deduce answers from empirical evidence that they collect and find for themselves what there is to see.

In the Torah, God takes Abraham outside, and says, "Gaze now, towards the heavens and count the stars if you are able to count them!" (Genesis 15:5). To perceive all that could be, Abraham would use evidence he personally observed. His personal journey from idolatry to monotheism reflects in Rabbi Heschel's words:

> The greatest hindrance to knowledge is our adjustment to conventional notions, to mental clichés. Wonder or radical amazement, the state of maladjustment to words and notions, is, therefore, a prerequisite for an authentic awareness of that which is.[3]

At Heschel, our students see for themselves.

1 John Dewey, "My Pedagogic Creed," *School Journal*, Vol. 54 (January 1897), pp. 77–80. Available at http://dewey.pragmatism.org/creed.htm

2 A.J. Heschel, *Man Is Not Alone: A Philosophy of Religion* (New York: Farrar, Straus and Giroux, 1976), p. 12.

3 Ibid., p. 11.

Daniel Abramson is an artist, photographer, and teacher. At The Toronto Heschel School his classes include Junior High science and art.

The Architecture of the Classroom

BY LISA RENDELY

Architecture: the art or science of building; specifically: the art or practice of designing and building structures and especially habitable ones.[1]

The Toronto Heschel classroom is a metaphor for the students' broader existence. Rabbi Heschel instructs us to build our life "as if it were a work of art." Outwardly thinking, we do not always associate art with science, yet the scientific method and creative process have distinct parallels. Both rely on testing, observing, and revising. The *Merriam-Webster Dictionary* may define architecture as "art or science," but the architecture of a classroom cannot extract one from the other. It is both. It combines methodical approach and aesthetic rigour, the systematics of the left brain and the flexibility of the right. This duality demonstrates Toronto Heschel's approach to education, and, by extension, its classroom design.

Teachers assume the role of scientists and organize their classrooms as pedagogical laboratories. Space is configured to maximize learning, adaptability, and student development during the experimental process that is each school year. Scientists use reliable processes and defensible hypotheses to probe new limits; likewise, teachers use evidence-based educational research to enhance students' intellectual, physical, emotional, and spiritual progress. It requires flexible thinking, adaptive reuse of existing spaces, and understanding their students as dynamic and variable participants. Teachers methodically arrange each piece of furniture, and equipment, large and small, in a planful approach to functional classroom design.

Celebrated American architect Louis Sullivan coined the phrase, "Form follows function." Toronto Heschel teachers follow this axiom. One "function" we aspire to is for students to learn to work both independently and collaboratively. Sometimes they must sit alone and sometimes in clusters. The "form" that follows is for younger children to sit at tables in small groupings that encourage easy communication and collaboration. Older students sit in a U-shape that fosters full-group dialogue and democratic sensibilities. Both forms still render the space flexible for movement, privacy, and community.

Sullivan's axiom also relates to the plants growing in each classroom. One overarching educational goal is to nurture students' functional assumption of responsibility for themselves and for living things outside themselves. The form that supports this function is the regular care of an array of classroom plants and flowers. Students monitor the plants and flowers daily, track their growth, and solve problems that arise. They are learning to apply methodical principles to their care for others; it begins with caring for the plants and flowers, and spreads outwards to their community and the environment.

Unlike high school classrooms that are dedicated to single subjects, elementary classrooms transition between activities continually each day. Only a classroom which rearranges itself easily into different configurations can be an effective backdrop where space and time unfold organically around students for the writers' workshop, science lab, lunch spot, art gallery, or lecture hall. The transformations require research and method. Like architecture itself, classroom design must be artfully considered and precisely implemented.

> Just as a person cannot be fully understood through the physical realm alone, so the physical place-making does not live fully if the metaphysical nature of the created place (be it psycho-social or the spiritual) is ignored.[2]

A Heschel classroom achieves its pleasing, harmonious aesthetic from rigorous technical systems. It mimics the precision of a well-crafted scientific experiment that allows no time or space for the superfluous, and includes only the necessary elements. All visual clutter goes. The teacher reduces variables to highlight intentionally placed visual triggers and information. Walls illustrate ideas and vocabulary. Masterworks of fine art pique the students' interest in multi-layered meaning in a multi-layered manner.

All visual clutter goes. The teacher reduces variables to intentionally placed visual triggers and information.

Because Heschel teachers guide students in the thinking habits of masters of each academic discipline—historian, scientist, artist, poet—they enrol authentic and important materials and procedures. A presentation of masterworks of art is particularly strategic, given the integrated and interdisciplinary nature of the program. Students are exposed very early to a variety of artists and expressions.

Each unit of study has its own masterwork, plus a table of artifacts that relate thematically or concretely to the topic at hand. The artifacts might be books, tools, typewriters, stones, plants, or other tangible objects; their tactile manipulation engages all senses. The display twigs new ideas. Students return and reconsider the masterwork and collected items over time, initially to test their first interpretation, then to formulate new hypotheses. The arrangement supports deeper insight, broader relevance, more meaning.

The curated presentation of masterworks and artifacts reflects the students' capabilities back to them, importantly confirming that their teachers trust them to appreciate profound expressions and handle valuable objects. It is further evidence that their classroom is an authentic place of learning, a true laboratory, not a placeholder with cartoon materials that must suffice until they reach a certain age.

> Architecture articulates the experiences of being-in-the-world and strengthens our sense of reality and self; it does not make us inhabit worlds of mere fabrication and fantasy.[3]

For consistent accurate results, scientists ensure their materials are pure and unadulterated. Heschel teachers want their students to have a pure focus on what is critical to their learning. They eliminate superfluous stimuli from the room, reduce visual noise and clutter. They may post a few graphics for quick reference, depicting a mathematical or writing method, but remove everything extraneous from the classroom. Through refined images and conscientiously curated visual arrangements, students can more easily become familiar with vocabulary, processes, and how segments of the curriculum relate to one another.

For example, in each unit in his Grade 5 Torah curriculum, teacher Isaac Hollander showcases a key image relating to the text being studied; he puts it up on the wall and repeats it in the students' workbook. He also displays vocabulary words that are colour coded to remind students of related terms and ideas. The images and words remain visible throughout the year as a manifest timeline of the Exodus from Egypt, and of how far student learning has come. The linearity and rigour of Hollander's practice is precise; it embeds the learning in the students' minds.

In the lab, a scientist knows where his/her materials belong and never leaves Bunsen burners, chemicals, or fragile beakers lying around. Similarly, to end clutter and to provide a sense of calm order and to assure focus, there is a purposeful place for everything in the classroom. Materials relating to other subjects do not lie strewn around the room and students are fully aware of what is on the agenda. Teachers insist students keep each item where it belongs. They appreciate that students' active roles in maintaining classroom organization further enhances their engagement with the learning at hand.

Considering the classroom as scientists managing their labs, Heschel teachers ready the room for the action they intend inside. The minimal, yet naturalized, aesthetic sets up a climate for learning on multiple levels; students learn from curated wall images reflecting themes and concepts, from well-tended plants and flowers, and from one another. The structured space awaits their meaningful exploration of materials, pro-social interactions, and strategies and concepts in literature, math, art, and science.

1 *Merriam-Webster Dictionary*, accessed July 12, 2018, https://www.merriam-webster.com/dictionary/architecture

2 Sarah Menin and Flora Samuel, *Nature and Space: Aalto and Le Corbusier* (London: Routledge, 2003), p. 8.

3 Ibid., p. 11.

Lisa Rendely teaches Grade 5 and visual art at The Toronto Heschel School. She studied and practised architecture before pursuing a career in education, and integrates art and design in her daily classroom teaching.

The Science of Sound and the Sound of Science

AN INTERDISCIPLINARY APPROACH IN GRADE 4

BY NECHAMA DROOKMAN AND SHACHAR LEVEN

"*Tekkiah… Truah… Shvarim… Tekkkiah Gedolah…*" Grade 4 students lie still, mindfully listening, as jarring blasts of a shofar echo off their classroom walls. How does the sound smell, feel, or taste? What colours does it bring to mind? While it's not surprising that questions like these can ignite imaginative thinking in poetry class, they can also play a role in learning the science of sound.

Receiving the prestigious Princess of Asturias Award in Spain in 1989, the late Stephen Hawking, author of *A Brief History of Time*, pondered,

> What can be done to harness interest, and give the public the scientific background it needs to make informed decisions on subjects like acid rain, the greenhouse effect, nuclear weapons, or genetic engineering?

He answered his own question by saying,

> Clearly, the basis must be what is taught in schools. But science in schools is often presented in a dry and uninteresting manner. Children learn it by rote to pass examinations. But they don't see its relevance to the world around them.[1]

Relevance matters. In elementary school, teaching science as a certain approach to the physical world makes students associate it with terminology, formulae, and method. When teachers present science as a separate discipline, a branch of knowledge unto itself, students gain the narrow view that it is simply a matter of content. We choose to teach science differently.

Our Grade 4 students encounter "Sound" as their first unit of study when they arrive at school in September. The unit encompasses discipline-specific notions, such as decibels, sound waves, amplitude, and frequency, but also broadens from the scientific context to a multivalent narrative that includes a variety of classes and disciplines in tandem.

The concept of "sound" jumps from the science textbook into a language arts lesson. In the words *Tekkiah… Truah… Shvarim… Tekkkiah Gedolah*, students are reading transcriptions for how the shofar lets us transform sound into linguistic form. They recognize that sound is language, words that are spoken as well as written down. They realize that beautiful poems are born from blasts, blows, honks, and whistles; the low-pitched *Truah* evokes melancholy while the high-pitched shrill *Shvarim* inspires upbeat frenetic verses.

Language itself is sound. Sound patterns for words offer endless possibilities for meaning. The science of sound sneaks into poetry through onomatopoeia (glubba-glubba-glubb-ity-glubs), alliteration (woods…lovely, dark and deep), and rhyme (stars that over-sprinkle/…heavens seem to tinkle). Students learn to harness the musical, "sound-like" elements of language in order to understand and compose poetry.

The poetic device that delivers an author's intended meaning and linguistic effect is the variation of sound. A student may hear, "The sky was blue and I was happy," and imagine a smiling person under a blue sky. He/she may realize that the more evocative "a sapphire-streaked sky and a sunshiny smile" opens minds and hearts to a different intensity or more specific options. Sounds rouse feelings and paint vivid mental images.

In second-language learning, hearing and speaking the "sounds" of Hebrew help with discerning grammatical variances—ילדים שמחים שרים ורוקדים\ילדות חכמות צוחקות ורוצות (*Yiladim smechim sharim u rockdim/Yeladot chachamot tzochakot u ratzot*). Grade 4 students play strategic "sound-based" games to master Hebrew's linguistic patterns. They use rhythm and rhyme, clapping a beat and chanting pairs of pronouns and verbs in order to internalize the conjugation pattern. They learn grammar by pairing sound with movement. Familiarity and fun with beats and sound paradigms bring Hebrew alive. A second-language learner can learn to conjugate verbs through rote memorization and repetitive writing, but it is a less than optimal mnemonic plan.

Ears are an obvious, but less than usual, focus for students' evolving experience of Jewish prayer and liturgy. During the weekly Kabbalat Shabbat service, where the prayer Mizmor LeDavid (Psalm 29) reveals King David's perception of the nature of God's voice, the children read that David describes God's voice as resonating in the water, in fire, and in the majestic (הדר). God's voice "shatters the Cedar trees…and shakes the wilderness." Using the science of pitch, amplitude, and timbre, students decode and differentiate one allegory from the next, visualizing and internalizing the metaphoric "sounds" of God. "What does the voice of God sound like to me?" students wonder. "What does the voice of God sound like to others?" Their complex understanding of sound lets them engage with the prayer personally and spiritually with God.

A culminating Social and Environmental Studies project requires students to explore a single source of sound, perhaps a soccer match, a lion's roar, or a baby's cries. Their task has four parts:

1. to explain the sound in the scientific language of decibels, frequency, and amplitude;
2. to identify emotions that it elicits in them;
3. to render or find images that mirror the emotion; and
4. to compose poems to convey these feelings. The project integrates learning from visual arts, language arts, and science for results that demonstrate an understanding of sound in its many dimensions.

To answer Stephen Hawking's concern, we teach Grade 4 science in an interdisciplinary manner. The *Oxford Dictionary* defines science as, "The intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment."[2] Our students engage in "intellectual and practical activity" that first notices, then examines sounds in all its forms, dimensions, behaviours, and attributes. Their "systematic study" covers the objective and the subjective; their senses, capabilities, emotions, and reflections. Their observations and experiments include language, arts, mathematics, prayer, song, and more. Our Grade 4 students will understand science as a wide open lens, through which they can view and consider the world at large.

1 Stephen Hawking, "Prince of Asturias Award for Concord 1989" (Speech), Princess of Asturias Awards, http://www.fpa.es/en/princess-of-asturias-awards/laureates/1989-stephen-hawking.html?texto=discurso&especifica=0

2 *English Oxford Living Dictionaries*, accessed July 12, 2018, https://en.oxforddictionaries.com/definition/science

Nechama Drookman and **Shachar Leven** are elementary school teachers at The Toronto Heschel School.

Language itself is sound. Sound patterns for words offer endless possibilities for meaning.

Curiosity and Wonder in the Early Years

BY SIGAL COHEN AND SARI HERSON

Sticky fingers
Look at that!
Muddy pants
What is this?
Looking closer
Why is that?
Outside searching
I think I know!
Listening quietly
Can I try?
Wondering, conjecturing
But why is that so?
I want to know.

Children are natural scientists. As babies they test for object permanence—fascinated by the reappearance of a face in the game of peekaboo; as toddlers, they engage in experiments, loving to see how water splashes or knocking objects down to see how they fall and roll. Through a proto-scientific method, children discover that hot means hot and that if they squash a beetle, it's not coming back. They learn that it doesn't feel good to crash towers they build and it's not fun to lose or damage playthings. Once they start to speak, they ask a million questions.

In the Early Years program at The Toronto Heschel School we help our young scientists develop their natural-born scientific habits of heart and mind. We begin with open-ended exploration that evolves into more formal modes of scientific investigation. During their outdoor explorations, students investigate the school's green space and garden at their leisure, searching for tiny creatures and observing new growth and seasonal changes. As educators, we nurture the scientific mindset by supporting their curiosity, encouraging them, and supplying a scaffolding of skills that enable the young students to delve deeper and answer questions they didn't know they had.

One spring afternoon a student approached a teacher, pointed to what he had found lying on the soil of a garden bed, and asked curiously, "What is this?" Numerous students gathered around asking more questions. Through investigation, the group came up with a hypothesis for what it could be. They determined, after close observation and bringing it to their noses, that it was a sprouting garlic clove which should have been deeper in the soil. The children replanted it and watched it during future explorations.

Some scientific habits of heart and mind—curiosity and wonder, creativity and inspiration—occur in young children naturally; others, such as responsibility, self-regulation, and organization, must be learned and developed. Research by leading psychologists, such as Roy Baumeister, now shows, "that the ability to self-regulate is essential to the development of the learning skills and work habits that are critically important to student success throughout the grades."[1] Self-control, systematic thinking, order, and respectful collegiality must partner with exploration and curiosity.

Science is the domain of the curious. It is the investigative approach to the physical world, and yet it is only as valuable as its competency to test for reliable answers. Without regulated systems and order, exploration is simply fun.

To develop young scientists, we have *toranut* in our Early Years classroom. The classroom is our laboratory. It's where we learn, and it requires our care and attention. The Hebrew term *toranut* translates as "tour of duty," but is used commonly at summer camps for kitchen duties and cleanup. We use it to denote students' classroom responsibilities. Like good scientists, they learn to behave responsibly in their lab, working well with their peers, and taking care of their supplies and the environment in which they learn.

Through *toranut*, our students, like scientists, learn to be attentive and systematic in how they interact with their surroundings, including in the lab. The children receive their *toranut* jobs and participate in organizational systems of the classroom, such as turning off the lights as we leave a room, watering our indoor plants as needed, and taking the compost to the outside garden bin.

Our overall curriculum is designed intentionally in ways that help our young scientists develop their researcher identities. For example, an overarching theme across the Senior Kindergarten curriculum is "Communication happens in many ways. When we listen and watch carefully, we can learn new ways to communicate." The art and craft of scientific thinking flows from communication: science asks what is the world telling us? Looking, noticing, and inquiring are important scientific practices as well as skills for communication.

To discover how nature communicates, the students take clipboards and paper outside. Examining the willow tree, its trunk, bark, branches, and aerial roots, they notice the texture, the earth, and the creatures nearby. They make detailed sketches and come away with questions about the root system and soil, "How deep do the roots go? Is there water underground? Will the roots reach the school? Why is there moss on the tree? What animals live here?"

To answer their inquiries, we model and apply the scientific method. We might investigate, for example, the soil. The children learn that they can hypothesize based on their experiences with gardens at home or at school. Some may know that, in soil, one might find worms, ladybugs, dead leaves and branches. We experiment, mixing water and soil in a jar and, observing closely, discover the various characteristics and contents of soil. To take it wider, we compare the properties of our school's willow tree with an acacia tree in the Arava Desert in Israel. We learn that the same questions bring different answers in different places. And the questions and connections continue.

When children can apply their natural curiosity and learn scientific practices to a hands-on project, an appreciation for the power of science blossoms. Gardens are the perfect research spot for young children. In the spring, Toronto Heschel's outdoor space is primed and ready for planting and our Senior Kindergarten students dig into the dirt, planting sunflower seeds in the school's learning garden. (Sunflower seeds grow quickly and can be checked on frequently for rapid changes!) The students visit the gardens often, measuring plant growth and journalling their observations. Once again, the process prompts many questions. The children ponder the impact of weather and precipitation on soil conditions and sunflower growth. They reflect and hypothesize what they might find in the garden tomorrow.

Together, students and teachers witness and celebrate their plants' growth from tiny seeds to flourishing sunflowers that reach for sun and sky. Just as the school year ends, and our young students ripen into budding scientists, so do our sunflowers. As educators, we hope our students apply scientific thinking to everything they encounter, whether they are at school, at home, or at camp, or in nature.

1 R.F. Baumeister and K.D. Vohs, *Handbook of Self-Regulation: Research, Theory, and Applications*, 2nd ed. (New York: Guilford Press, 2011).

Sigal Cohen and **Sari Herson** are Early Years teachers at The Toronto Heschel School.

Our Sages Tell Us

Good Books

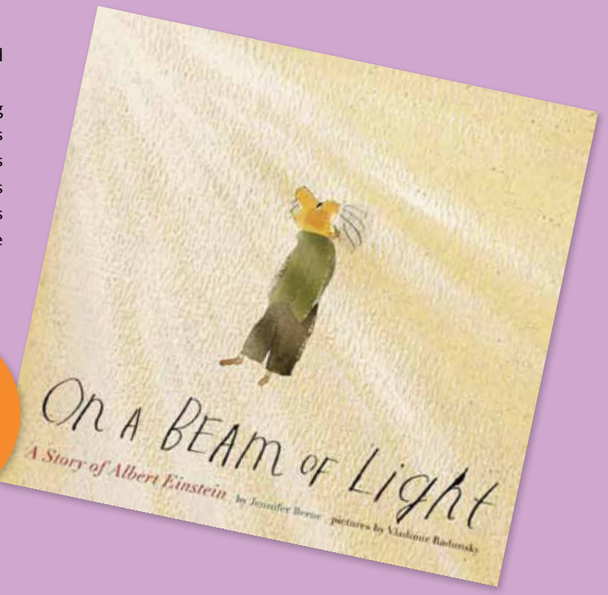
by Gail Baker & Tziporah Cohen

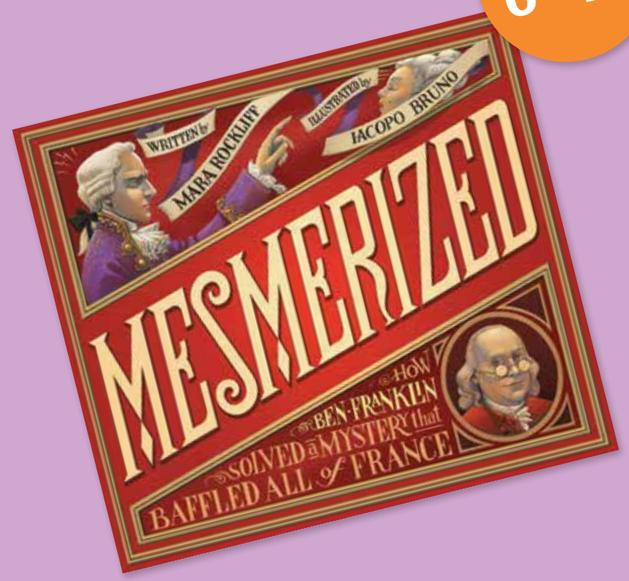
RECOMMENDATIONS FOR CHILDREN AND THE PEOPLE WHO LOVE THEM

Gail Baker is an educator, a mother, and grandmother. In 1996 she co-founded The Toronto Heschel School and retired as Head of School in 2014.

Tziporah Cohen is a psychiatrist with an M.A. in Fine Arts in Writing for Children and Young Adults and is a Toronto Heschel mom.

On A Beam of Light: A Story of Albert Einstein by Jennifer Berne and illustrated by Vladimir Radunsky (Chronicle Books, 2016)
A little baby grows full of curiosity and wonder, looking and thinking about everything that's around. This delightful picture book follows Albert Einstein as he matures into one of the most brilliant scientists of the 20th century. Music and science connect. When Albert feels blocked or stuck on an idea, he plays his violin until his mind relaxes and he can continue to think and investigate. The illustrations are earnest, yet playful, like Albert himself.





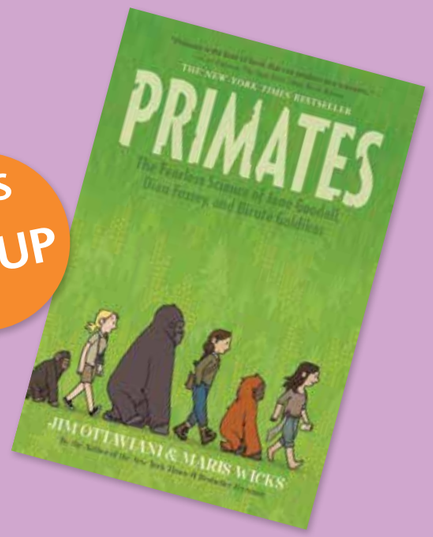
Mesmerized: How Ben Franklin Solved a Mystery that Baffled All of France written by Mara Rockliff and illustrated by Iacopo Bruno (Candlewick Press, 2017)
Benjamin Franklin arrives in France in 1776 to find the French enthralled by Dr. Charles Mesmer and his "force" that makes "a glass of water taste like twenty different things" and cures a variety of ailments instantly. Readers of all ages will be captivated by this fascinating account of how Franklin used the scientific method to debunk mesmerism (hypnotism). Dynamic illustrations and a detailed author's note show how Franklin observed, hypothesized, and experimented in order to conclude that Mesmer's force was, in fact, the placebo effect. Franklin's discovery is important to this day.

AGES 9&UP

Women in Science: 50 Fearless Pioneers Who Changed the World, written and illustrated by Rachel Ignotofsky (Ten Speed Press, 2016)
Phoebe Sarah Marks, later known as Hertha Ayrton, was born in England in 1854. Despite being poor and a woman, she became an engineer, mathematician, and inventor. The success of the clean and quiet street light that Hertha invented made her too important for the male scientists of her time to ignore. Her story, one of spunk and persistence, is but one of 50 inspirational life stories in this wonderful collection. A must read!

Primates: The Fearless Science of Jane Goodall, Dian Fossey, and Biruté Galdikas by Jim Ottaviani and illustrated by Maris Wicks (First Second Books, 2013)
Much of our knowledge about chimpanzees, gorillas, and orangutans in the wild stems from the dedication of Jane Goodall, Dian Fossey, and Biruté Galdikas. This semi-fictionalized narrative about the life work of these three primatologists makes it clear that strong observational science requires grit and determination, and that many setbacks complicate the path to exhilarating discovery. The graphic novel format is perfect for this visually striking tale of three women who will inspire naturalists of all ages.

AGES 12&UP



SHALOM HARTMAN מכון INSTITUTE שלום הרטמן

LSI THE LOLA STEIN INSTITUTE

The Shalom Hartman Institute and The Lola Stein Institute present

The Senior Educators Forum

Year 9 convenes heads of Jewish day and supplementary schools, department heads, rabbis, and lead educators in the community.

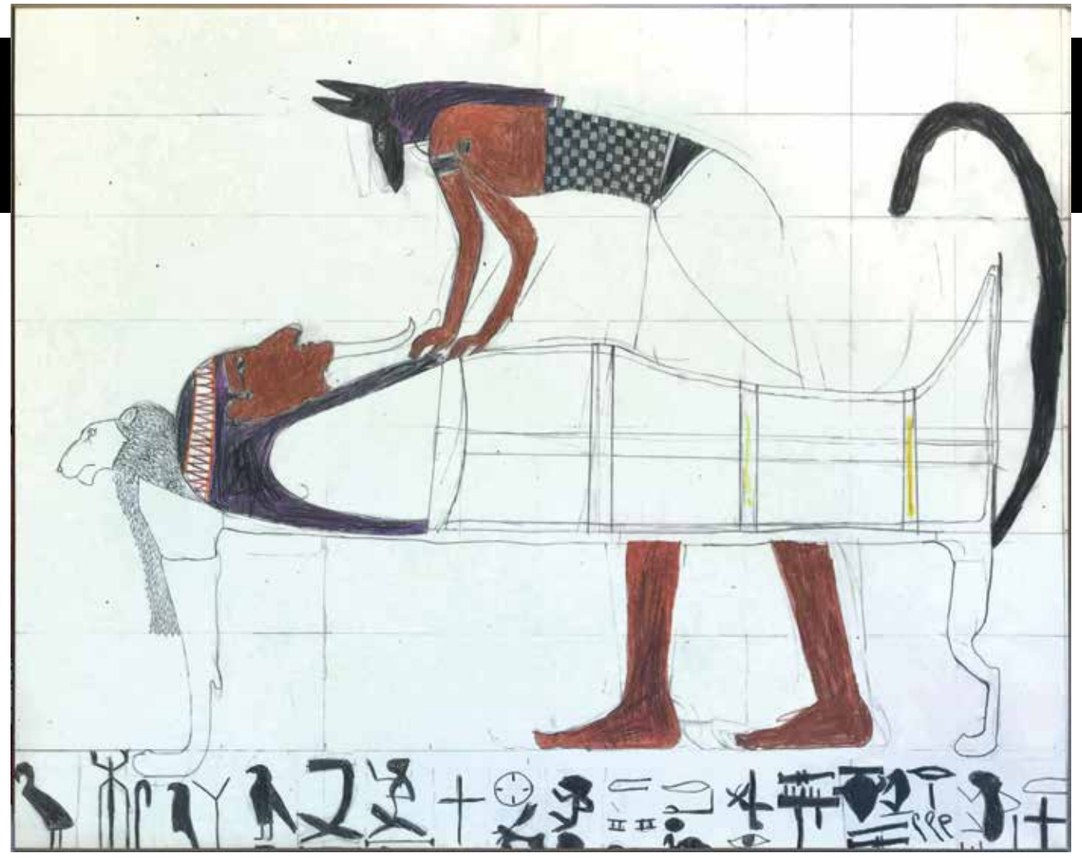
Curriculum 2018–2019:
Diaspora: Two Thousand Years of Relationship
Lunch and study from 12:00pm–2:30pm at central Toronto locations.
For more info, visit: http://www.lolastein.ca/senior-educators-forum.html

NEW for 2018–2019

The School Leaders Forum

This NEW Forum welcomes board and committee members of Jewish day and supplementary schools to meet in 6 evening sessions across the 2018–2019 school year.

Curriculum 2018–2019:
Can the Jewish Past Shape Our Future?
We have long relied upon the experience, text, and wisdom of our Jewish past. Is this looking backwards to look forwards now countercultural and counterintuitive? What remnants of the past can guide us ethically, morally, and spiritually?
Dinner and study from 6:30–9:00pm at central Toronto locations.
For more info, visit: https://www.lolastein.ca/school-leaders.html



Science and Memory in Our Bones

LIANE STEIN

Elie Wiesel's Holocaust testimony carries the memory of those who died, just as the Israelites carried Joseph's bones to Canaan. Eric Kandel's latest collaborations link bones with memory longevity.

It is no coincidence that the Hebrew word for essence, עצם (*Etzem*), also translates to mean bone. Throughout literature, bones symbolize the ineffable quality of essence, for example, one metaphor for human instinct is to "feel something in our bones," another idiom describes the "bones of an argument." In turn, the notion of essence seems to synthesize a past, present, and future, aligning the profound interrelation between memory, experience, and action.

So, if memory is essential to who we are, what connects it to our body? What happens to a person's essence when memory is gone? And, isn't it interesting that links drawn between memory and bones in biblical text, rabbinic scholarship, and philosophy beautifully mirror recent research in physiology?

At the end of the Book of Genesis, Joseph rescues his family from drought in Canaan and brings them to Egypt. Later, before his death, he commands his family to take his bones home with them when they return to the land of Israel (Genesis 50:25). By making his family promise to move his bones, he is forcing them to remember him, in effect, to understand their past as tied to their future, their essence, their identity. Joseph's bones represent memory.

According to midrash, Serach, daughter of Asher, is the one person who remembers where Joseph's bones were buried. Serach's memory is foundational to Jewish identity—the bones of Joseph. Blessed with a long life, 400 years after Joseph's death, she shows Moses where Joseph's coffin was sunk into the Nile, enabling Moses to fulfil his ancestors' promise: "And Moses took the bones of Joseph with him: for he had straightly sworn the children of Israel, saying, God will surely visit you; and ye shall carry up my bones away hence with you" (Exodus 13:19).

In rabbinic scholarship, our actions, the doings of our bones, also link inextricably to essential understanding. At Mount Sinai, the Israelites were told, "*Na'aseh v'nishma*"—meaning "Do and understand." The "and" is the critical component of this text. Talmudic discussion questions and compares the roles of deeds and learning; is either more important than the other? Doing does not mean understanding, understanding does not mean doing; the text seems to say that understanding and doing do not compete and should not stop each other from happening. They are dynamically symbiotic.

Maybe the adage "*na'aseh v'nishma*" is a biblical platform for intuitive knowledge? God's words reveal the essence of goodness within the Israelite men and women gathered at Mount Sinai; the imperative implies that instinctive knowledge (the "do") and subconscious understanding (the "understand") come together. "We will do," means we will obey your words, which are already ingrained within us. Isn't it interesting to see the Torah link the notion of human essence with the idea of action? Within Judaism, what we do defines who we are inside.

The link between action and memory and identity appears also in the words of great thinkers. Marching for racial equality at Selma with Reverend Martin Luther King Jr., Rabbi Abraham Joshua Heschel said, "I felt my legs were praying." The essence of Heschel's philosophy manifests itself in the active pursuit of social justice. Heschel's spiritual strivings came through his action, the workings of his bones.

Elie Wiesel also uses memory to relate essence with identity. He won the 1986 Nobel Peace Prize for his humanitarian work and messages of peace, including his testimony of Hitler's death camp, told through the voice of a 15-year-old boy. Wiesel's writings are bearing witness to the Holocaust; they carry the bones of those lost in the Second World War, in the same way that the Torah has the Israelites bearing Joseph's bones to Canaan.

Wiesel writes that "to forget is to abandon, to forget is to repudiate." In *The Forgotten*, he wonders what is left when a person loses his/her memory; what of their essence remains? Diseases, such as Alzheimer's, are comparable to a cancer of memory; they erode the essence of a person. *The Forgotten* leads us to ask questions about what we are and where lies our essence? Are we essentially a composite of neurological synapses firing in our brains? Are we our capacity for complex cognition? Are we our memories; are we our spiritual beliefs?

Dr. Eric Kandel, a 2000 Nobel Prize Laureate for his studies on the molecular basis of learning and memory, gave a talk last fall in Toronto. His latest research, which is in collaboration with Dr. Gerard Karsenty's lab at Columbia University, investigates links between age-related memory loss and osteocalcin, a hormone produced by bone cells (osteoblasts). Their study, performed on mice, reveals that osteocalcin acts on the brain's centres for memory and anxiety reduction. The more osteocalcin a mouse produced, the more the mouse could remember and the less anxiety it expressed.

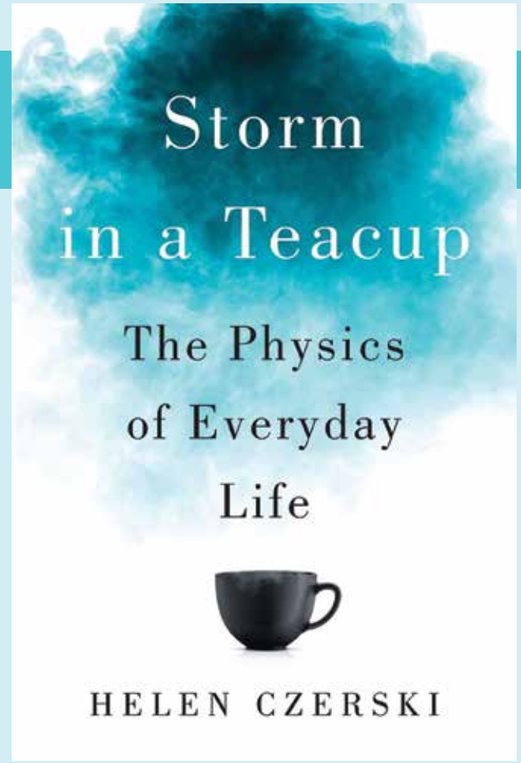
Osteoblasts are bone-building bone cells; they produce the osteocalcin hormone, are most active in the young, and decline naturally with age. Their activity is triggered by stresses and strains on bones that arise with weight-bearing activity, such as walking or dancing. In the study, the more the mice used their bones, the more they produced osteocalcin; the more they produced osteocalcin, the more they stimulated their memory and anxiety-reducing brain centres. In effect, physical weight-bearing activity mitigates age-related memory loss.

To examine the link between activity and memory scientifically, the researchers first deleted the gene that makes the osteocalcin. Without the ability to make osteocalcin, the mice rapidly lost their memory-retention capacities and displayed more anxiety. The second experiment saw older mice regain memory when given injections of osteocalcin. In fact, the infusions improved the animal's performance on memory tests to reach levels typically seen in young mice. (It is important to note that disease plays a role; the research does not show osteocalcin to impact neurological diseases, such as Alzheimer's or dementia.)

Kandel's research connects bones with memory longevity. Now, isn't it interesting to find this affiliation among the words of brilliant modern-day thinkers and in the Torah? Our essence and our memory are intrinsic to our bones. Science can prove it. Through Torah, philosophy, and science, we can learn how to maintain the essence of who we are.

Liane Stein, M.Sc., is a Toronto Heschel alumna. She spent last winter painting at the Art Students League of New York and begins medical school this fall.

A single explanation expands to become a pattern and the pattern becomes a way to understand more of the world.



Storm in a Teacup

A BOOK REPORT

BY KAREN CHISVIN

Curiosity, joy, play, discovery, effort, and reward: these are the qualities that can make each of us a scientist. When we toss off the expression, "It's a tempest in a teapot" (or, in British English, "A storm in a teacup"), we usually mean that something has been exaggerated out of proportion and that our reaction to it is similarly excessive. Yet under the guidance of Helen Czerski, in her book *Storm in a Teacup: The Physics of Everyday Life*, we learn that a storm in a teacup is not an exaggeration at all. Rather, it might reveal a little of the mystery of the world with every stir of the spoon.

If we observe closely, work out what is really going on, find a pattern, test our conclusions, and "persist in the face of the non-obvious at first attempt," then we will have discovered something fundamental about the natural world. We will have done some science. We will be rewarded at each step of the process, we will make connections, and we will benefit from "seeing [that] what makes the world tick changes [our] perspective."[1]

Czerski is a lecturer in the Department of Mechanical Engineering, University College London. She describes herself as "a physicist with a love for the natural world." She cares "deeply about exploring the ideas and challenges in the physical world around us. Even the most familiar daily objects can open the door to the way the universe ticks." Czerski believes "that everyone should feel comfortable in playing with that world," and her book is an invitation to do so.

In her introduction, Czerski establishes some of her rationale for the book. "Humans are curious about the world, and we get a lot of joy from satisfying our curiosity. The process is even more rewarding if you work things out for yourself, or if you share the journey of discovery with others." The following eight chapters are a guided tour of many basic principles of science, designed by a most engaging leader. In each chapter, Czerski draws in the reader with an anecdote based on an observation about something very ordinary and familiar—popcorn popping, raisins bobbing in a soda bottle, fogged up swim or ski goggles, the swirl of milk, and tea in a teacup are just a few examples. She expresses curiosity about the observation and then asks, "What's going on?"

This question drives the discovery process. Czerski shows us how to think through a situation to come up with an explanation, and then applies the principles to other phenomena. A single explanation expands to become a pattern and the pattern becomes a way to understand more of the world. Throughout the book, Czerski simplifies the complex with lively, equation-free writing that can appeal to readers with any level of scientific knowledge.

We are enticed to explore chapters with names like "Popcorn and Rockets," "Why Ducks Get Cold Feet," and "When Opposites Attract." It's a reassuring way to approach the scientific topics that Czerski covers, which include gas laws, gravity, scale effects, equilibrium, waves, state changes, spinning forces, and magnetic forces. The main chapters are linked by the writing style and by vignettes from her personal life, but each can stand alone and be read in any order.

For example, if you have ever spent time trying to get ketchup out of a bottle—holding the bottle upside down, shaking it vigorously, tapping the bottom of the bottle—only to first meet resistance and then face a gush of ketchup, then a middle chapter, "A Moment in Time," could be a good place to start reading. In this chapter Czerski takes us from pub to garden; from a city square full of pigeons to earthquakes in New Zealand; from raindrops to mountains.

We learn that there are molecules in ketchup that are all tangled up, keeping it like a solid. Moving the ketchup at just the right speed untangles some of the molecules and causes it to behave like a liquid: "It's all about time… The speed at which things happen matters." We are warned that even though sometimes when we do things at double speed we get to our results faster, at other times changing the speed changes the results completely. The same kind of action that allows ketchup to flow or not is what lets the snail move in the garden without leaving a surface and determines whether an earthquake will cause the ground to liquefy or not. The chapter continues with a discussion of equilibrium, oscillation, and frequency with real-life examples that show that living systems never quite achieve equilibrium. It ends with the big questions: "How did life start?" and "Is there life anywhere else in the universe?"

Czerski's last chapter, "A Sense of Perspective," claims that we all rely on three powerful and parallel support systems—the human body, planet Earth, and our civilization—and that having a better understanding of all three is what we need to thrive as individuals and as a society. This last chapter is more poetic and integrative than the preceding ones. The premise is that "knowing some basic bits of physics turns the world into a playbox." So the picture described in this chapter is one of Czerski's conceptions. She creates this by applying science at all scales to create an integrative picture of the universe and our place in it. We are encouraged to share the wonder, and to be inspired to do the science for ourselves.

1 Helen Czerski, *Storm in a Teacup: The Physics of Everyday Life* (New York: W.W. Norton, 2017). All quotations are from this book.

Karen Chisvin is an alumni parent and an early co-chair of The Toronto Heschel School Board. She is a practising architect, working in professional development.

Remembering Hunters and Gatherers

WHERE IS THE MEANDERING CHILD?

BY JASMINE ELIAV

Parents should also think like scientists. Through observation, gathering information, and contemplation, we better understand our children.

Once upon a time there were few shortcuts. Yes, you could cut through a field to buy milk at the store, but somehow there was always work to be done. To get through, as we know, humans had to learn diligence and perseverance. They knew that the process matters.

An anthropological look back remembers that we spent thousands of years hunting and gathering in the wild. We developed techniques such as watching, waiting, and wondering. We meandered through fields thoughtfully, noticing details and situations in nature. Achievement in the wild demanded specific understandings and more skill in scientific thinking than children get away with today in the push button world of Google Search.

Gathering took time; it involved search, instruction, attention to task, and interpersonal skills. Science was born of this tradition to slowly and thoroughly examine the world. A method to observe and test and learn was how we made sense of things and advanced our understanding. The mental pathways, which developed thanks to these practices, evolved into patterns for how we habitually engaged with the world.

Imagine hunters and gatherers staying alive by reading unmarked signs in nature. Consider the complex brain structures at work; wandering and foraging required men and women to navigate terrain, predict weather; learn habits of animal species; craft and use tools; dig, collect, and prepare roots, nuts, and plants; create shelter. We can see meandering as groundwork for complex learning, including creativity, enhanced memory, reflection, highly integrated knowledge systems, flexible problem-solving, attention to detail, and dynamic patterns of thinking.

The number of complex skills that our ancestors used is probably more than those we use in a world of simplified and condensed knowledge. Our "helpful" shortcuts sometimes cross onto thin ice and we must notice the risks and developmental costs that are inherent in an automated world. To minimize disadvantages and maximize these benefits, technology needs grounding in the physical world.[1]

What does this mean for our children and what can we do about it? First, we have to recognize various paradoxes that emerge as we beeline for the quick fix; for example, how the Internet—the most widely used world lens—can be both mind expanding and mind limiting, a place where we can be alone together, a mode of communication that may be context and content free, and where quickly paced judgments resemble deep contemplation.

Once we see these confusing challenges, we have simply to reinfuse life and meaning back into hunting and gathering. We have to reconsider meandering as an important expansive skill and reintroduce method into our children's lifestyle.

The scientific process provides both method and framework to help children learn to think, act, and reflect. Like hunters and gatherers, they can learn to practise quiet attention, observation before speaking, and contemplation of relationships and context. They can learn to take the time to wonder in what context they notice what exists and why.

The same applies to parents. For two clear reasons parents should also remember to think like scientists. First of all, because parents need to discover their own children. They are often less than fully cognizant of their children's skills and interests and aversions. Secondly, because their children will emulate them. According to a meta-ethnographic review of 58 studies on hunters and gatherers, children observing their parents and, at times overimitating, was noted to be central to how children gain competency in many foraging tasks.[2]

As a child psychologist, when parents ask me to support their child, I often request something that may seem unsophisticated. I ask a parent to take the child on a 30-minute walk as consistently as possible. The walk should not be an errand, an opportunity to multi-task, or time to get the dog out. It should not be a time to evaluate the child or teach a lesson. The simple purpose of the walk is to be together, uninterrupted, and for the parent to follow the child's lead.

Early in my career, at a children's mental health centre, we used an approach called "Watch, Wait, and Wonder" created by Mirek Lojkasek, a clinical and developmental psychologist. Caregivers were tasked to follow their infant's lead as the infant engaged in free play and, while doing so, they were to reflect. This process enhances caregivers' sensitivity and responsiveness to their child, as well as the child's sense of self and regulation of emotion. Overall, it improved the caregiver–child relationship.

I ask parents to walk with their children in order to cultivate the same process of reflection. I ask them to listen as the children walk and speak freely. Parents can later consider what kinds of information children are sharing, what themes arise in their stories, and what they are trying to convey to the parent about their sense of self and how they experience the world.

Through observation, gathering information, and contemplation, that is, thinking like scientists, we set up a clearer lens through which to better understand our children. Also, in doing so, we are "walking the walk." We are reflecting back to our children the very important lesson that grounding our thoughts in the real world, as we meander along, opens the space for deep thinking.

1 Sherry Turkle, *Alone Together: Why We Expect More from Technology and Less from Each Other* (New York: Basic Books, 2011).

2 S. Lew-Levy, R. Reckin, N. Lavi, J. Cristobal-Azkarate, and K. Ellis-Davies, "How Do Hunter-Gatherer Children Learn Subsistence Skills?" *Human Nature*, Vol. 28, No. 4 (December 2017), pp. 367–394.

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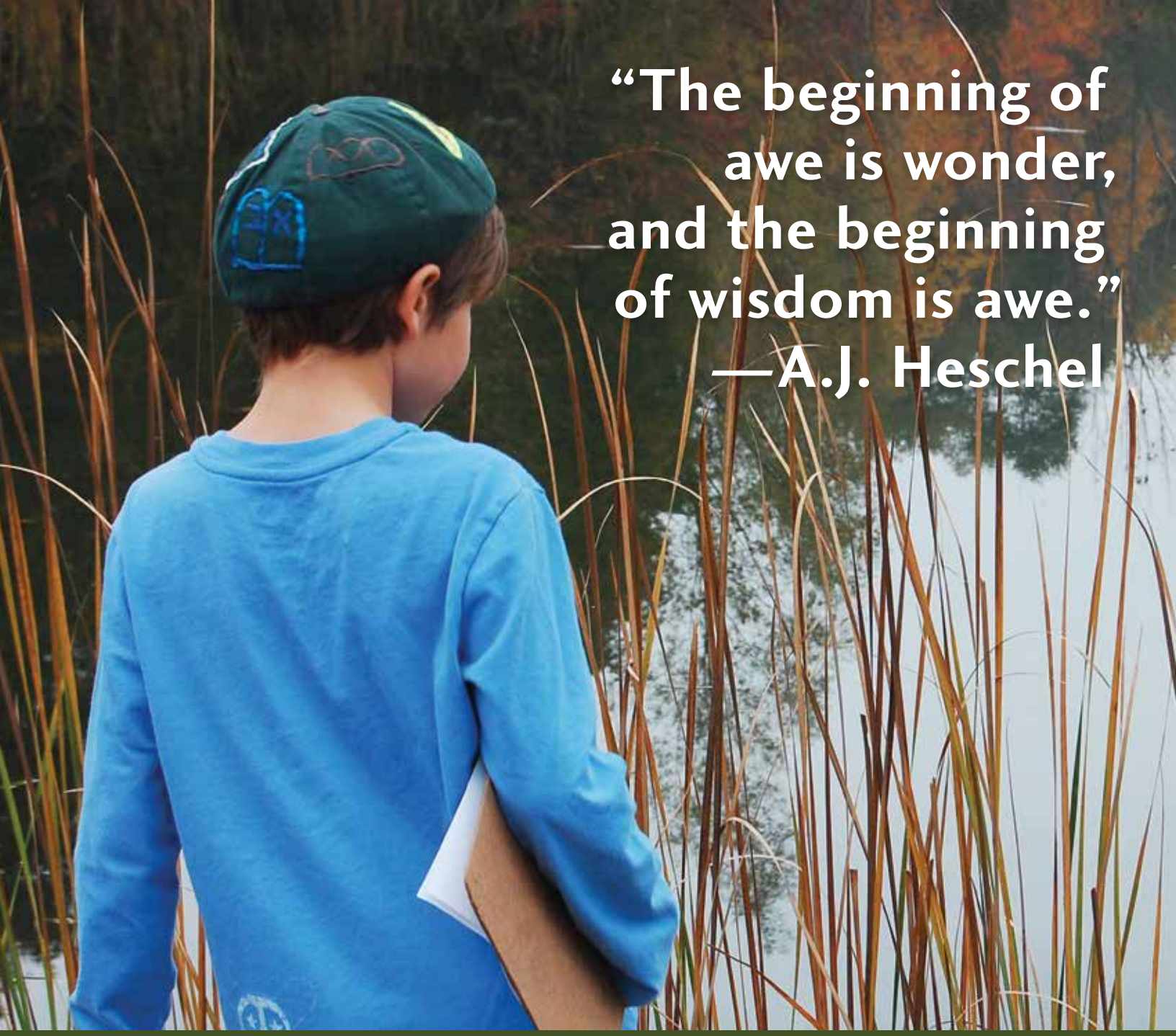

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