

A World Premiere

THE HOW and THE WHY

Written by Sarah Treem | Directed by Emily Mann

JANUARY 7 - FEBRUARY 13, 2011

Smart | Engaging | Incisive

McCARTER
THEATRE CENTER

609.258.2787 | www.mccarter.org

91 University Place | Princeton, NJ 08540

2010-2011 Theater Season sponsored by **verizon**wireless



This program is made possible in part by funds from the New Jersey State Council on the Arts/Department of State, a Partner Agency of the National Endowment for the Arts and by funds from the National Endowment for the Arts.



Smart, Engaging, Incisive

Evolution and emotion collide in **Sarah Treem's** thought-provoking and sharp new play about science, family, and survival of the fittest. On the eve of a prestigious conference, an up-and-coming evolutionary biologist wrestles for the truth with an established leader in the field. Featuring Tony and Oscar winner **Mercedes Ruehl** and **Bess Rous**, this intimate and keenly perceptive play explores the difficult choices women of every generation face.

Emily Mann on *The How and the Why*



Dear Patrons,

There are some scripts one simply can't put down—they grab you, and you must go along for the ride. I will never forget the first time I read Sarah Treem's *The How and the Why*. I knew—almost immediately—that I had a smart and profound, thought-provoking and funny, sublime and brilliant new play in my hands. And I knew that McCarter's audience absolutely had to see it.

The How and the Why is a play about sex and gender, power and age, nature and nurture, loss and love. It is a play that compels us to examine some of the unexplored questions of what it is to be a woman—biologically, socially, politically, and emotionally. It is also a great relationship play—about two women of different generations desperately trying to find a common ground. Sarah's dialogue is sharp and her characters complex; but most of all, her ideas are challenging—both intellectually and emotionally.

I first met Sarah several years ago when she was a student working for her MFA at the Yale School of Drama. We shared a car ride and a discussion and found a shared set of artistic ideals and values. Since then, Sarah's career has grown tremendously. She's had her plays produced around the country, and she now serves as a writer and supervising producer for HBO's acclaimed series, *In Treatment*. Hers is an important voice that will continue to be heard in the American theater; I'm thrilled that McCarter's audience will be the first to see this wonderful, engaging, and absolutely unforgettable play.

A handwritten signature in black ink that reads "Emily Mann". The signature is fluid and cursive, with a large loop at the end.

p.s. If you want your conversation with *The How and the Why* to continue after the final curtain, I urge you to visit our Company Store in the lobby and purchase a copy of the play to enjoy at home.

Intergenerational Collaboration

We are particularly delighted to introduce playwright Sarah Treem to McCarter audiences with the world premiere of *The How and the Why*. Exercising the brain and the heart in equal measure, *The How and the Why* is the compelling story of Rachel and Zelda, evolutionary biologists from different generations, one in her late twenties, one in her late fifties. These women struggle with big scientific questions as well as with sociological and personal ones—what is the biological purpose of menstruation and menopause? What makes a mother? How do women navigate the male dominated world of science?

The How and the Why will be directed by artistic director Emily Mann. Emily and Sarah's strong personal and professional connection is grounded in mutual admiration. For Sarah, Emily's work as a playwright was a major influence long before she became her director. "Still Life changed the way I thought about writing when I read it in my early twenties. It's a play about perspective. Three people with different takes on the same relationship. In a way, I think that's how *The How and the Why* works as well....Emily gets it. It's a play about smart women who are making difficult choices. She's faced them herself. For me, this play is about what it means to be the daughters of the feminist generation. Does the so-called 'backlash' really exist and if so, what is it about? The first time I sat down with Emily we talked about her experience at Harvard in the 70s and my experience at Yale at the turn of the millennium. It was a fascinating conversation...what had changed...what remained exactly the same."

For Emily, this thoughtful perspective is at the center of what draws her to Sarah's work: "Sarah's very brave. She takes on big questions, big ideas, and puts them in the mouths of real people. She's beyond her years in that kind of skill. And she has a great sense of humor."

While Sarah and Emily's intergenerational pairing parallels Rachel and Zelda's, the collaboration has been a much easier one. Said Sarah, "Like the characters, we're approaching the material from two different perspectives...but the fundamental argument that these two women are having is the fight that I have been having in my own head for many years. And I think Emily knows the fight inside and out, herself. So, while we might initially come at the conflict from different perspectives, we both ultimately understand the complexity of the question and the fact that there is no answer."

– Carrie Hughes

Evolution is the most important concept in biology. There is not a single Why? question in biology that can be answered adequately without a consideration of evolution. But the importance of this concept goes far beyond biology. The thinking of modern humans, whether we realize it or not, is profoundly affected—one is almost tempted to say determined—by evolutionary thinking.

Ernst Mayr, *What Evolution Is*, 2001

A Conversation with Sarah Treem and Emily Mann

Q: What inspired you to write about scientists?

SARAH TREEM: I had a boyfriend who gave me a book about female physiology, *Woman: An Intimate Geography*, by Natalie Angier. I read about these two theories. One was about something called The Grandmother Hypothesis, the other was called The Toxicity of Sperm, and they struck me as really interesting.

Q: Emily, can you talk a little bit about how you first got to know Sarah and what your first impression was of her work?

EMILY MANN: Blair Brown was doing *The Tempest* for me here and she kept talking about this fabulous writer named Sarah Treem. Sarah had written a wonderful play called *A Feminine Ending* and I read it and loved it. Then, Mark Subias, her agent, called out of the blue, and said there's a new play that my client Sarah Treem has written that I think is absolutely up your alley, and it was this play. I picked it up to read the first page. I had to be somewhere and I couldn't put it down. I finally called and said I was going to be 20 minutes late. I put it down and thought, I have to do this.

ST: I had actually met Emily once when I was at Yale Drama School and I begged to pick her up at the train station. I loved her play *Still Life*. I saw it as an undergrad. I remember, I was [at a point in my career where I was wondering] how does one write a play? What I learned from reading *Still Life* was... you put people in a room who have very good reasons to be furious at each other and you don't let them leave. That's how you create dramatic tension. *The How and the Why* is somewhat based on that principle.

Q: Sarah, do you think this is a play about science?

ST: Yes, yes, the play is definitely about science. But I think the center of the play is the relationship between these women. I was interested in what it means for me and my generation to be the daughters of the feminist generation.

EM: Sarah and I are the ages exactly of the women in the play.

ST: Susan Faludi had an article in *Harper's* about the generational divide in the feminist movement. According to her, the two groups of women have a hard time talking to each other. I found, growing up, that I heard a lot of mixed messages from older women talking to me about feminism.

Q: Emily, what made you want to do this play?

EM: I have never seen these characters onstage. I have never seen two incredibly and equally intelligent and ambitious women struggle with the balance of the personal and the professional in this kind of passionate way. I think it's a conversation that should be had. Many women of my generation ended up being able to break through the barriers; we knocked down those closed, if not locked, doors, and your generation has what we didn't have—entrance. And yet we didn't answer some enormous life questions. We left unanswered questions that have to do with how one can live a fulfilling life as a woman in those worlds that were once exclusively for men. Can it be done? I hope your generation will build on what we began and didn't finish. I know some of you are angry at us for not doing more.

ST: Coming back to whether this is about science or not... the characters talk about science as any discipline in which the fools of this generation should be able to go past the genius of the last generation. In this play, the scientific argument serves as a metaphor for the generational conflict. And the characters actually have a harder time letting go of emotional intelligence from generation to generation than scientific principles.

Q: You talked about our generation getting mixed messages—did writing this play clarify those messages, or did it change your mind, to get inside both characters?

ST: That's an interesting question. When I started the play, I was convinced that one character had to be right, and the other, wrong. For a long time I was trying to figure out who was going to win this fight—in terms of what a woman's life path should be, which choices she should make. There had to be an *answer* to the "woman question." What I figured out with this draft is... they're both right... and wrong. And that's the only possible answer. The only truth there is.

Who's Who



Mercedes Ruehl (*Zelda Kahn*)

Broadway: *Lost in Yonkers* (Tony, Drama Desk, Outer Critics, and Helen Hayes Awards); *The American Plan*; *The Goat, or Who Is Sylvia* (Outer Critics Circle Award, Tony nomination); *The Rose Tattoo*; *Shadowbox* (Tony nomination); and *I'm Not Rappaport*. Off-Broadway: *The Occupant*, *Woman Before A Glass* (Obie Award), *Other*

Peoples' Money (Clarence Derwent Award), *The Marriage of Bette and Boo* (Obie Award), *Who's Afraid of Virginia Woolf* at the Guthrie Theatre. Film: *The Fisher King* (Academy, Golden Globe, and LA and Chicago Film Critics Society Awards), *The Warriors*, *Big*, *Married to the Mob*, *Last Action Hero*, *Lost in Yonkers*, *What's Cooking*, *For Rosanna*, *The Minus Man*. TV: HBO's *Indictment: The McMartin Trial* and *Gia*, Hallmark's *The Lost Child*, Court TV's *Guilt by Association*, Showtime's *North Shore Fish*, CBS's *Loving Leah*, Lifetime's television film *A Girl Like Me*. TV appearances: recurring roles on *Frasier* and HBO's *Entourage*.



Bess Rous (*Rachel Hardeman*)

Off-Broadway: *From Riverdale to Riverhead* (Studio Dante), *Open House* (The New York International Fringe Festival and The Lion Theatre at Theatre Row). Regional: *The Diary of Anne Frank* (Roundhouse Theatre). Film: *What Just Happened*, *The Hungry Ghosts*. TV: *Law & Order: SVU*, *Mad Men* (Recurring), *Gossip Girl*

(Recurring), *Law & Order* (Seasons 15 and 20), *Army Wives*, *New Amsterdam*, *Third Watch*, *Damage Control*, and *Loving Leah* (CBS/Hallmark). She is a graduate of The Mason Gross School of the Arts at Rutgers University (BFA) and The London Academy of Theatre.

Sarah Treem (*Playwright*) is the only writer to have written and produced all three seasons of the acclaimed HBO series, *In Treatment*, for which she won a WGA award and was nominated for a Humanitas award. She is also a writer/producer for the Mark Wahlberg/Stephen Levinson produced HBO series *How to Make it in America* and is currently adapting Samantha Peale's

When I was in school, Biology was a subject that seemed as exciting as a clump of cotton wool. It was a dreary exercise in the memorization and regurgitation of apparently unconnected facts. Only later did I learn about evolution and how it transforms biology from that mass of cotton wool into a magnificent tapestry, a tapestry we can contemplate and begin to understand...I am proud to be part of the riot of nature, to know that the same forces that produced me also produced bees, giant ferns and microbes that live at the bottom of the sea.

Olivia Judson, *The New York Times*, 2006

novel *The American Painter Emma Dial* for HBO with Philip Seymour Hoffman and Emily Ziff. Sarah participated in the 11th annual Tel Aviv-Los Angeles Film and TV Master Class in Israel in July 2009 and in a conference titled "How They Did It: Turning an Israeli series into HBO's *In Treatment*" for New York Women in Film & Television in March 2010. Her full-length plays include *Empty Sky*; *Against the Wall*; *Mirror, Mirror*; *A Feminine Ending*; and *Human Voices*. *A Feminine Ending* received its world premiere at Playwrights Horizons in fall 2007, was subsequently produced at South Coast Repertory and Portland Center Stage in 2008, and is published by Samuel French, which has also published *Mirror, Mirror*. *Human Voices* was part of Manhattan Theater Club's Spring Board New Play Series and New York Stage & Film's Powerhouse Reading Season in 2007. Sarah has been in residence at The Sundance Institute, The Ojai Playwriting Conference, The Screenwriters Colony, and will soon be in residence at the Yaddo Artists' Colony. She has been commissioned by South Coast Repertory and Playwrights Horizons, and she is a current fellow at the Lark Playwrights' Workshop. Sarah has taught playwriting at Yale University, where she earned her BA and MFA.

As an evolutionary biologist I'm acutely aware that we're in a coevolutionary race with everything else. That's my fundamental way of looking at the world.

Margie Profet, interview by Shari Rudavsky, 1994

Emily Mann (Director) Multi-award-winning Director and Playwright Emily Mann recently celebrated her 20th season as Artistic Director of McCarter Theatre. Under Ms. Mann's leadership, McCarter was honored with the 1994 Tony Award for Outstanding Regional Theater. Directing credits include Nilo Cruz's Pulitzer Prize-winning *Anna in the Tropics* with Jimmy Smits (also on Broadway); the world premiere of Christopher Durang's *Miss Witherspoon* with Kristine Nielsen (also off-Broadway); *Uncle Vanya* with Amanda Plummer (also adapted); *All Over* with Rosemary Harris and Michael Learned (also off-Broadway; 2003 Obie Award for Directing); *The Cherry Orchard* with Jane Alexander, John Glover, and Avery Brooks (also adapted); *Three Sisters* with Frances McDormand, Linda Hunt, and Mary Stuart Masterson; *A Doll House* with Cynthia Nixon; and *The Glass Menagerie* with Shirley Knight. Her plays include the multi-award-winning *Execution of Justice*; *Still Life* (six Obie Awards); *Greensboro (A Requiem)*; and *Annula, An Autobiography*. Ms. Mann wrote and directed *Having Our Say*, adapted from the book by Sarah L. Delany and A. Elizabeth Delany with Amy Hill Hearth (Tony, Drama Desk, Outer Critics Circle nominations; NAACP Award, Joseph Jefferson Award, Peabody and Christopher Awards and WGA nomination for her screenplay). A winner of the Dramatists Guild Hull-Warriner Award, she is a member of the Dramatists Guild and serves on its Council. A collection of her plays, *Testimonies: Four Plays*, has been published by Theatre Communications Group, Inc. Her latest play, *Mrs. Packard*, was the recipient of the 2007 Kennedy Center Fund for New American Plays Award and was published by TCG in spring 2009. Most recently, Ms. Mann directed her latest adaptation, *A Seagull in the Hamptons*, a free adaptation of Chekhov's *The Seagull*, with Brian Murray and Maria Tucci; *Mrs. Warren's Profession*, with Suzanne Bertish; and the world premiere of Edward Albee's *Me, Myself & I* (with Tyne Daly and Brian Murray at McCarter Theatre and with Elizabeth Ashley at Playwrights Horizons). In 2002, she received an Honorary Doctorate of Arts from Princeton University.

Daniel Ostling (Set Design) McCarter: *Having Our Say*, *Argonautika*, *Lookingglass Alice*, *The Secret in the Wings*, *The Odyssey*. New York: *La Sonnambula*, *Lucia di Lammermoor*

(Metropolitan Opera); *Glorious Ones* (Lincoln Center); *Durango* (Public Theater); *Pain and the Itch* (Playwrights Horizons); *Lookingglass Alice* (New Victory); *Metamorphoses* (Broadway - Tony nomination, Second Stage); *Measure for Measure* (New York Shakespeare Festival); *Arabian Nights, Galileo Galilei* (BAM). Recent Regional: *Candide* (Goodman, Shakespeare Theatre); *Becky Shaw* (South Coast Rep); *Macbeth, Much Ado About Nothing* (California Shakespeare); *Arabian Nights* (Berkeley Rep, Arena Stage); *Death of a Salesman* (Dallas Theatre); *Tom Sawyer* (Hartford Stage); *Trust* (Lookingglass); *Merry Widow* (Lyric Opera); *Civil War Christmas* (Huntington Theatre); *Up* (Steppenwolf); *Lookingglass Alice* (Actor's Theatre, Lookingglass, Broadway). International: Donmar Warehouse, Barbican (London); Melbourne Theatre. Ensemble member at Lookingglass Theatre. Works extensively with writer/director Mary Zimmerman. Associate Professor at Northwestern University.

Jennifer Moeller (Costume Design) Credits include: *Richard II, Romeo & Juliet, Antony & Cleopatra, Julius Caesar, Tamburlaine*, and *Richard III* (Shakespeare Theatre Company), *Six Degrees of Separation* (Williamstown Theatre Festival), *Happy Now?* (Primary Stages), *Crooked* (sets) and *Aliens with Extraordinary Skills* (Women's Project), *Circle Mirror Transformation* and *The Seafarer* (George Street Playhouse), *The Sacrifices* (Summer Play Festival), *Dance of the Holy Ghost* (Yale Repertory Theatre), *Sweeney Todd* (Barrington Stage Company), *Waiting for Godot* (Berkshire Theatre Festival), *Winter's Tale* (Chautauqua Theatre Company). MFA from Yale School of Drama.

Stephen Strawbridge (Lighting Design) has designed the lighting for productions on and off Broadway, at most leading regional theaters and opera companies across the US and internationally in Bergen, Copenhagen, The Hague, Hong Kong, Lisbon, Munich, Naples, Sao Paulo, Stockholm, and Vienna. At McCarter: *Having Our Say* and *School for Scandal*. Recent work includes: *Happy Days* for Westport Playhouse; *The Battle of Black and Dogs* for Yale Repertory Theatre; Athol Fugard's *Coming Home* for Berkeley Rep and Long Wharf Theatre; *School Boy Play* for the Linz 09 Festival in Austria; *At Home at the Zoo* (American Conservatory Theater); and *Crime and Punishment* (Berkeley Rep). He has been nominated for or won the American Theatre Wing, Bay Area Critics Circle, Dallas Theater Critics Forum, Helen Hayes, Henry Hewes Design, Lucille Lortel and Outer Critics Circle Awards. He is co-chair of the Design Department at Yale School of Drama and resident lighting designer at Yale Repertory Theatre.

Robert Kaplowitz (Sound Design) Credits include: Bill T. Jones' *Fela!* (Broadway and the National Theatre in London), John Beluso's *The Poor Itch*, Lemon Anderson's *County Of Kings*, and a handful of others at The Public; David Adjmi's *Stunning* (LCT3); Kia Corthron's *Light, Raise the Roof* (NYTW); Abbey Spallin's *Pumpgirl* (MTC); Chloe Moss's *This Wide Night* (Naked Angels); Adam Bock's *The Thugs* (SoHo Rep); and *A Small Fire* (Playwrights Horizons). He has also designed for 2nd Stage, LAByrnth, MCC, Primary Stages, The Vineyard, The Arden, Interact, the O'Neill Playwrights Conference, Sundance, PlayPenn, and others. He received a Tony for *Fela!* and an OBIE for Sustained Excellence in Sound Design off-Broadway for the 2006-7 season.

Calendar of Events

For a complete calendar of events, please visit:
<http://www.mccarter.org/howandwhy/html/8.html>

The Science Behind the Play

The two women in *The How and the Why* are described as brilliant evolutionary biologists. While the characters Sarah Treem created are fictional, the theories they present are real. Controversial in their respective fields, the *Grandmother Hypothesis* and the *Menstruation as a Defense* theory are revolutionary and complicated and have affected how the scientific community perceives women and their bodies.

Please note: these theories are revealed over the course of *The How and the Why* so you may want to wait until after the production to read more about these radical ideas!

Grandmother Hypothesis

The Grandmother Hypothesis explains why a woman's reproductive capabilities end considerably before her natural life. Building on ideas first proposed by George C. Williams in 1957 and subsequently expanded and refined by other researchers, prominently recently by Kristen Hawkes, it suggests an evolutionary benefit in menopause for women, who can then focus all of their energy and resources on the survival of their existing children and grandchildren. This hypothesis has enormous implications on how humans developed apart from other primates. With older women assuming caretaking roles, offspring could stay weaker and more dependent for a longer period of time allowing their brains to develop.

“An end to a woman's reproductive years allows her to channel her energy and resources into caring for her children and grandchildren, thereby providing her descendants with a survival advantage.”

“Evolution's Secret Weapon: Grandma” *The New York Times*, Tara Parker-Pope (October 5,2007)

Click on these links to read more about evolutionary biology

Evolution Is

Ten Great Advances in Evolution

Paradigm shifts are the stuff of scientific revolutions. They change how we view the world, the sorts of questions that scientists consider worth asking, and even how we do science. The discovery of **DNA** marked one such shift, the theory of plate tectonics another.

Douglas H. Erwin, *The New York Times*, 2007

"A [post-menopausal] grandmother has a decidedly beneficial effect on the reproductive success of her children and the survival of her grandchildren ... Women whose fertility is ending [have] an opportunity to influence the reproductive success of their daughters and survival of their grandchildren through assistance in food provisioning. In an ancestral population that was shifting from chimpanzee-like feeding to hard-to-handle foods, the more vigorous elder females could help more, thereby increasing the representation of their vigor in descendant generations, shifting rates of ageing, and lengthening average adult lifespans."

"The Grandmother Effect" *Nature*, Kristen Hawkes (March 2004)

"Long post-menopausal lifespans distinguish humans from all other primates. This pattern may have evolved with mother-child food sharing, a practice that allowed aging females to enhance their daughters' fertility, thereby increasing selection against senescence. ... this hypothesis also accounts for our late maturity, small size at weaning, and high fertility. It has implications for past human habitat choice and social organization and for ideas about the importance of extended learning and paternal provisioning in human evolution."

"Grandmothering, menopause, and the evolution of human life histories" *The National Academy of Sciences*, K. Hawkes, J.F. O'Connell, N.G. Blurton Jones, H. Alvarez, and E.L. Charnov (February 1998)

Menstruation as Defense

In her 1993 article, "Menstruation as a Defense Against Pathogens Transported by Sperm," Margie Profet introduced the scientific community to a controversial new theory about the function of menstruation. According to Profet, women shed their uterine lining as a way to protect themselves from possible infection caused by pathogens introduced to the uterus by sperm. The body attacks this foreign matter in two ways: by shedding the lining of the uterus and washing it clean with blood rich with immune cells. This hypothesis was a radical shift in how menstruation is often perceived (many cultures consider it dirty and women on their periods are thought to be bad luck).

"Margie Profet of the University of California at Berkeley suggests that menstruation evolved as a mechanism for protecting a female's uterus and Fallopian tubes against harmful microbes delivered by incoming sperm ... The uterus is extremely vulnerable to bacteria and viruses that may be hitching a ride on the sperm, and menstruation is an aggressive means of preventing infections that could lead to infertility, illness and even death. In menstruation ... the body takes a two-pronged attack against potential interlopers: it sloughs off the outer lining of the uterus, where pathogens are likely to be lingering, and it bathes the area in blood, which carries immune cells to destroy the microbes."

"Radical New View of Role of Menstruation" *The New York Times*, Natalie Angier (September 1993)

“A new interpretation of menstruation sees it not as a passive loss of unused uterine lining but as an aggressive way to prevent infection by viruses and bacteria carried into the reproductive tract along with sperm. Menstruation sloughs off the potentially infected lining and bathes the area in blood carrying immune cells. The lining of the uterus is served by special spiral-shaped arteries that first constrict under hormonal stimulation, killing cells of the lining, and then dilate, creating a blood flow that washes the cells away. The protective theory is supported by the fact that there is a high concentration of disease-fighting macrophages in menstrual blood, which also lacks clotting factors, helping maintain the cleanup flow.”

“Radical New View of Role of Menstruation” *The New York Times*, Natalie Angier (September 1993)

“Sperm are vectors of disease. During mammalian insemination bacteria from the male and female genitalia regularly cling to sperm tails and are transported to the uterus ... Menstruation functions to protect the uterus and oviducts from colonization by pathogens. Menstrual blood exerts mechanical pressure on uterine tissue, forcing it to shed, and delivers large numbers of immune cells throughout the uterine cavity, directly combating pathogens.”

“Menstruation as a Defense Against Pathogens Transported by Sperm” *The Quarterly Review of Biology*, Margie Profet (September 1993)

The How and the Why: Glossary

Adrenal glands: Triangular endocrine glands on top of the kidney that produce hormones such as adrenaline (also called epinephrine, adrenaline stimulates the heart muscle during the fight-or-flight response by increasing glucose levels in the blood and providing quick energy).

Amenorrhea: Absence of the menstrual period in women of reproductive age.

B cells: Lymphocytes (immune system cells) that make antibodies (proteins that bind to and initiate the removal of foreign substances in the body).

Bonobos: Sometimes called Pygmy Chimpanzees, found in the Democratic Republic of the Congo and currently endangered. Very closely related to humans. They are studied for a variety of reasons, one being their active and varied sexual lives (they use sex for more than reproduction, for example, to negotiate, as therapy, etc).

BRCA 1: Gene officially called breast cancer 1, early onset. It is a tumor suppressing gene that produces proteins which prevent cells from growing/dividing too rapidly and repair broken DNA strands. Mutations or variations of BRCA 1 can lead to increased risk of breast cancer.

Carcinogen: Any substance, radionuclide, or radiation that is an agent involved in causing cancer.

Cervix: Lower, narrow portion of the uterus that joins with the top of the vagina. It opens to allow menstrual blood to flow out and dilates during childbirth. During pregnancy, however, it closes to keep the fetus inside the uterus.

Chromosome: Threadlike structure composed of coiled DNA and proteins that contains genetic information.

Dobzhansky Prize

Out of the twenty-nine evolutionary biologists who have received the Dobzhansky Prize since 1981 only three have been women. The first was **Elizabeth Anne Zimmer** in 1982. Zimmer works at the Smithsonian's National Museum of Natural History researching the development of DNA markers for understanding relationships and genome evolution among green plants. It wasn't until 2007 that another woman, **Franziska Michor**, was recognized with this prize. Michor applies evolutionary reasoning and approaches to a somewhat unconventional topic, the biology of cancer. **Judith Mank** was the Dobzhansky Prize winner in 2009. A lecturer at Oxford University, Mank explores the ways evolutionary forces act differently on male and female traits.

Cortisol: Steroid hormone produced by the adrenal gland. It is released in response to stress and increases blood sugar.

Dobzhansky Prize: Theodosius Dobzhansky Prize is awarded annually by the Society for the Study of Evolution to recognize the accomplishments and future promise of an outstanding young evolutionary biologist. The prize was established in memory of Professor Dobzhansky by his friends and colleagues, and reflects his lifelong commitment to fostering the research careers of young scientists. <http://www.evolutionsociety.org/awards.htm>

Edna St. Vincent Millay: American poet, playwright, and feminist, born in 1892 and died in 1950. She was the third woman to win the Pulitzer Prize for poetry.

Endometrial layer: Inner layer of the uterus. During the menstrual cycle and pregnancy the endometrium grows into a thick layer of tissue full of blood vessels.

Ernst Mayr: Leading evolutionary biologist of the 20th century; identified two parts of scientific problems, the how and the why.

<http://www.achievement.org/autodoc/page/may1bio-1>

http://www.pbs.org/wgbh/evolution/library/06/2/I_062_01.html

First trimester: Time from last period to 13th week of a pregnancy in human females. There are three trimesters in a human pregnancy.

Hadza: Hunting-gathering ethnic group from Tanzania. They are the last group of full-time hunter-gatherers and have a language unrelated to any other. Because of their unique lifestyle (not much in their way of life has changed in the last 10,000 years) they are the source of many studies of human nature and biology.

<http://ngm.nationalgeographic.com/2009/12/hadza/finkel-text>

Hypothesis: Proposed explanation of an observable phenomenon.

Hormone: Chemical released by a cell or gland in one part of the body that sends out messages that affect cells in other parts of the body.

Hormone replacement therapy: Treatment for women at or around menopause that involves medication containing female hormones that are no longer being produced by the body. While it lessens the discomfort of menopause and has proven health benefits, some treatments increase the risk of cancer and heart disease.

Hysterectomy: Surgical removal of the uterus.

George C. Williams: American evolutionary biologist. His paper, *Pleiotropy, Natural Selection, and the Evolution of Senescence*, contains an early outline for the grandmother hypothesis.

Gestation: Carrying of an embryo or fetus inside a female.

Grandmother Hypothesis: Theory explaining why menopause arose in humans and not other species as well as possible evolutionary benefits to a lengthy post-fertile period.

Lactoferrin: Protein in the immune system that binds to and transports iron. Lactoferrin is an antibacterial agent for human infants (its iron binding properties prevent the growth of bacteria).

Lamaze: Prepared childbirth technique (focus on breathing and relaxation).
<http://www.livestrong.com/article/116087-lamaze-breathing-exercises/>

Lymph nodes: Organs of the immune system. Found all through the body, they filter/trap foreign particles.

Macrophages: White blood cells that ingest foreign materials. They are a key player in the body's immune response.

Mastectomy: Surgical removal of one or both breasts.

Max Gluckman: South-African born British social anthropologist, put research emphasis on case studies and promoted conflict studies.

Menses: Monthly flow of blood and cellular debris from the uterus (another name for menstruation/the discharge during menstruation).

Mitochondria: Organelle (a structure within a cell that has a specific function) that converts energy into forms usable by the whole cell.

Nascence: Coming into being, a birth.

Nomadic: Moving from one place to another without settling anywhere.

Oncologist: Physician who studies, diagnoses, and treats cancerous tumors.

Ovulation: Release of a mature egg from the ovarian follicle.

Pathogen: Infectious agent; a germ that causes disease in its host.

Permeable: Having pores/openings that allow liquids and gases to pass through.

Petri dish: Small, shallow dish biologists use to culture (multiplying organisms by letting them reproduce in controlled lab) cells.

Phylogeny: Evolutionary history of a particular group of organisms or their genes.

Physiology: Subcategory of biology, a science of the function of living systems. Linked with anatomy, human physiology focuses on the organs and systems within systems.

Placenta: Organ that connects the developing fetus to the uterine wall to allow nutrient uptake and waste elimination.

Pleistocene: Epoch from 1.9 million-10,000 years ago, marked by glacial cycles. It also was the period of evolution and expansion of Homo sapiens.

<http://www.pbs.org/wgbh/evolution/change/deeptime/pleistocene.html>

Primordial: Pertaining to or existing at/from the beginning.

Protoplasm: Living content of a cell that is surrounded by a plasma membrane.

Prototype: Original form, serving as an example.

Ruth L. Kirschstein award: (National Research Service Award) for individual predoctoral/postdoctoral fellows given by the National Institute of Health.

Senescence: Biological aging that occurs in an organism after it reaches maturity. In evolutionary biology it is theorized that we have favored biological functions that increase our reproductive rate at a younger age, but which might contribute to an overall shorter lifespan. Mutations that prove fatal later in life are not selected out for a few reasons: the older we are the more likely we are to be vulnerable to many different risks, and we are also not as reproductively volatile the older we are.

Sexual proclivity: Natural/habitual tendency in sexual behavior.

Simian: "Higher primates" including humans.

Stockholm syndrome: In psychology, a paradoxical phenomenon where victims exhibit positive feelings towards their captors.

T cells: White blood cells involved in the cell-mediated immune response. They have special receptors on their surface, T cell receptors (TCR), that help other cells in the immunologic process.

Tangential: Touching lightly; of little relevance.

Toxicity: Degree to which a substance can damage an organism.

Trajectory: Path a moving object follows through space as a function of time.

Yerkes Primate Center: (Yerkes National Primate Research Center) located at Emory University. The Yerkes National Primate Research Center conducts essential basic science and translational research to advance scientific understanding and to improve the health and well-being of humans and nonhuman primates. <http://www.yerkes.emory.edu/>

Distinctions:

Primate: Biological order including: apes, monkeys, humans, prosimians.

Mammal: Air-breathing, vertebrate animals with fur/hair and females with mammary glands.

Monkey: (Non-hominoid) all primates that are not prosimians or apes.

Ape: (Hominoid) includes chimpanzees, orangutans, gorillas, and humans.

Harvard's School for Evolutionary Biology

NYU Department of Biology

Princeton Department of Ecology and Evolutionary Biology

***Life: The Science of Biology* Glossary**

Additional Resources

Angier, Natalie. *Woman: An Intimate Geography*. New York: Houghton Mifflin Company, 1999.

“Theorists See Evolutionary Advantages in Menopause.” *The New York Times* September 16, 1997.

“Radical New View of Role of Menstruation.” *The New York Times* September 21, 1993.

Barash, David P. and Judith Eve Lipton. *How Women Got Their Curves and Other Just-So Stories*. New York: Columbia University Press, 2009.

Diamond, Jared. “Why Women Change.” *Discover Magazine* July 1996.

Faludi, Susan. “American Electra.” *Harper’s Magazine* October 2010: 29-42.

Hawkes, K., J.F. O’Connell, N.G. Blurton Jones, H. Alvarez, and E.L. Charnov. “Grandmothering, menopause, and the evolution of human life histories.” *Anthropology* Volume 95 (February 1998): 1336-1339.

“The grandmother effect.” *Nature* Volume 428 (March 2004): 128-129.

Martin, Emily. *The Woman in the Body*. Boston: Beacon Press, 1987.

Profet, Margie. “Menstruation as a Defense Against Pathogens Transported by Sperm.” *The Quarterly Review of Biology* Volume 68, No. 3 (September 1993): 335-381.

Siegfried, Donna Rae. *Anatomy and Physiology for Dummies*. Hungry Minds: New York, 2002.

Williams, George C. “Pleiotropy, Natural Selection, and the Evolution of Senescence.” *Evolution* Volume 11, Issue 4 (December, 1957): 398-411.

Wilson, Robert A. *Feminine Forever*. New York: M. Evans and Company, Inc., 1966.

The searching human mind is not satisfied merely to discover facts. We also want to know how things happen and why. And beginning with Darwin, evolutionists have devoted enormous ingenuity trying to answer these questions, and in the process, have produced an abundance of answers.

Ernst Mayr, *What Evolution Is*, 2001

Links

The Society for the Study of Evolution

“The Hadza” *National Geographic*

PBS “Evolution”

Yerkes National Primate Research Center

Life: The Science of Biology Glossary



Core Curriculum Standards

According to the NJ Department of Education, “experience with and knowledge of the arts is a vital part of a complete education.” Our production of *The How and the Why* and the activities outlined in this guide are designed to enrich your students’ education by addressing the following specific Core Curriculum Content Standards for **Visual and Performing Arts**:

- 1.1 **The Creative Process:** All students will demonstrate an understanding of the elements and principles that govern the creation of works of art in dance, music, theater, and visual art.
- 1.2 **History of the Arts and Culture:** All students will understand the role, development, and influence of the arts throughout history and across cultures.
- 1.3 **Performance:** All students will synthesize those skills, media, methods, and technologies appropriate to creating, performing, and/or presenting works of art in dance, music, theater, and visual art.
- 1.4 **Aesthetic Responses & Critique Methodologies:** All students will demonstrate and apply an understanding of arts philosophies, judgment, and analysis to works of art in dance, music, theater, and visual art.

Viewing *The How and the Why* and then participating in the pre- and post-show discussions and activities suggested in this audience guide will also address the following Core Curriculum Content Standards in **Language Arts Literacy**:

- 3.1 **Reading:** All students will understand and apply the knowledge of sounds, letters, and words in written English to become independent and fluent readers, and will read a variety of materials and texts with fluency and comprehension.
- 3.2 **Writing:** All students will write in clear, concise, organized language that varies in content and form for different audiences and purposes.
- 3.3 **Speaking:** All students will speak in clear, concise, organized language that varies in content and form for different audiences and purposes.
- 3.4 **Listening:** All students will listen actively to information from a variety of sources in a variety of situations.
- 3.5 **Viewing and Media Literacy:** All students will access, view, evaluate, and respond to print, non-print, and electronic texts and resources.

In addition, the production of *The How and the Why* as well as the audience guide activities will help to fulfill the following **Science** Core Curriculum Standards:

- 5.1 **Science Practices:** All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

5.3 **Life Science:** All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

Pre-Show Preparation, Questions for Discussion, and Activities

*Note to Educators: Use the following assignments, questions, and activities to introduce your students to *The How and the Why* and its intellectual and artistic origins, context, and themes, as well as to engage their imaginations and creativity before they see the production.*

1. ***The How and the Why: Web Site Basics.*** Share the various interviews, articles and information found on McCarter's *The How and the Why* web site with your students—preferably by reading them aloud as a class or in small groups—to provide an intellectual and creative context for Sarah Treem’s smart, incisive, and engaging new play.
2. **In Context: The Who and the What of *The How and the Why.*** To prepare your students for *The How and the Why* and to deepen their level of understanding of the play’s distinctive world and its characters, have them research, either in groups or individually, the following topics:
 - Sarah Treem
 - Emily Mann
 - Evolutionary Biology
 - History of the study
 - Topics of study
 - Ernst W. Mayr
 - Theodosius Dobzhansky/The Dobzhansky Prize
 - Nikolaas Tinbergen/Tinbergen’s four questions
 - George C. Williams/“Evolution of Senescence”
 - Kristen Hawkes/“The Grandmother Hypothesis”
 - The Hadza people of Tanzania
 - Margie Profet/“Menstruation as a Defense” hypothesis
 - Women in Science (and Engineering and Medicine)
 - Statistical study
 - Education and employment
 - Abbreviated history
 - Antiquity – eighteenth century
 - Nineteenth century – twentieth century
 - National Academy of Sciences and women

Have students teach one another about their individual or group topics via oral and illustrated (i.e., posters or PowerPoint) reports. Following the presentations ask your students to reflect upon their research process and discoveries.

Women in Science PLAYWRITING. *The How and the Why* is a play about women in science, which was written by playwright Sarah Treem, and is directed by McCarter Artistic Director Emily Mann, who is an Obie Award-winning and Tony Award-nominated playwright. Although Treem and Mann prefer not to be labeled and defined solely on the basis of their gender, the fact remains that they are remarkable artistic anomalies in a professional field that has been traditionally dominated by men. The questions and educational activities below explore the phenomenon of the woman playwright in contemporary American culture.

What? Women Write Plays?

The first page of the **Women Playwrights' Initiative** web site poses a curious question followed by dispiriting statistics:

Can you remember the last play you saw *written by a woman*?

Most people can't.

62% in our last survey could not.

But here's the good news! That's UP 10%!...

Nationally, just 17% of plays produced on America's main stages are written by women.

Source: New York State Council on the Arts.

- Ask students if they can remember the last play they saw that was written by a woman.
- On one of your classroom white/black boards, have students list all of the women playwrights they can think of and the names of plays written by these female dramatists.
- On another white/black board, have them list all of the male playwrights they can think of and the names of their plays.
- Have students calculate the ratio of female playwrights to male playwrights that they can recollect.
- Discuss with your students the "how and the why" of the class's statistic and those above. Ask them to consider why they think that plays written by women seem to be so infrequently produced.

The Plays Women Write

Have your students break up into research teams of two or three to examine and report on the artistic work of the following contemporary American women playwrights:

- Constance Congdon
- Margaret Edson
- Rebecca Gilman

- Beth Henley
- Tina Howe
- Lisa Kron
- Emily Mann
- Ellen McLaughlin
- Marsha Norman
- Lynn Nottage
- Dael Orlandersmith
- Suzan-Lori Parks
- Theresa Rebeck
- Sarah Ruhl
- Anna Deavere Smith
- Diana Son
- Megan Terry
- Paula Vogel
- Naomi Wallace
- Wendy Wasserstein
- Mary Zimmerman
- Students should explore their playwright's biography and survey her creative output. Special attention should be paid to the following:
 - playwright's history of production
 - accessibility/availability of the playwrights work (i.e., publications)
 - awards and special achievements
 - subjects and themes of the dramatist's plays
- Students should also read one of the playwright's works in its entirety and prepare a representative scene to present to the class as a staged reading.
- Following the reports and scene presentations ask your students to reflect upon their research process and discoveries and to consider both common and divergent themes in the theatrical journeys of all of the playwrights studied.
- Ask students to consider from their body of research if they can detect any trends in subject matter or themes in the plays that women write. Ask them if the plays that women write are unique or unusual from the plays that men write. *How* they are different? *Why?*
- And finally, ask your students to consider again why they think that plays written by women seem to be so infrequently produced. Has their research in any way altered their opinions, or has it enforced their original assertions/beliefs?

Post-Show Questions for Discussion and Activities

*Note to Educators: Use the following assignments, questions, and activities to have students evaluate their experience of the performance of *The How and the Why*, as well as to encourage their own imaginative and artistic projects through further exploration of the play in production. Consider also that some of the pre-show activities might enhance your students' experience following the performance.*

1. ***The How and the Why: Performance Reflection and Discussion.*** Following their attendance at the performance of *The How and the Why*, ask your students to reflect on the questions below. You might choose to have them answer each individually or you may divide students into groups for round-table discussions. Have them consider each question, record their answers and then share their responses with the rest of the class.

Questions to Ask Your Students About the Play in Production

- a. What was your overall reaction to Sarah Treem's *The How and the Why*? Did you find the production compelling? Stimulating? Intriguing? Challenging? Memorable? Confusing? Evocative? Unique? Delightful? Meaningful? Explain your reactions.
- b. Did experiencing the play heighten your awareness or understanding of the play's themes? [e.g., the navigation of women in a male dominated sphere/world, nature vs. nurture, survival of the fittest, the challenging life and career of a scientist (with added challenge for women in science), generational conflict, mother-daughter/ parent-child relationships, what makes a mother, having it all, criticism/failure as defeat vs. a new opportunity, the trauma of loss and abandonment, etc.] What themes were made even more apparent or especially provocative in production/performance? Explain your responses.
- c. Is there a moment in the play that specifically resonated with you either intellectually or emotionally? Which moment was it and why do you think it affected you?
- d. Do you think that the pace and tempo of the production were effective and appropriate? Explain your opinion.

Questions to Ask Your Students About the Characters

- a. Did you personally identify with either of the characters in *The How and the Why*? Who? Why? If no, why not?

- b. What character did you find most interesting or engaging? Why were you intrigued or attracted to this particular character?
- c. What qualities of character were revealed by the action and speech of Zelda and Rachel? Explain your ideas.
- d. Did either character develop or undergo a transformation during the course of the play? Who? How? Why?
- e. In what ways did the characters reveal the themes of the play? Explain your responses.

Questions to Ask Your Students About the Style and Design of the Production

- a. Was there a moment in *The How and the Why* that was so compelling or intriguing that it remains with you in your mind's eye? Write a vivid description of that moment. As you write your description, pretend that you are writing about the moment for someone who was unable to experience the performance.
- b. Did the style and design elements of the production enhance the performance? Did anything specifically stand out to you? Explain your reactions.
- c. Did the overall production style and design reflect the central themes of the story of *The How and the Why*? Explain your response.
- d. What did you notice about the set design? Did it provide an appropriate and/or evocative setting/location for *The How and the Why*? How and why, or why not?
- e. What mood or atmosphere did the lighting design establish or achieve? Explain your experience.
- f. What did you notice about the costumes worn by Zelda and Rachel? What do you think were the artistic and practical decisions that went into the conception of the costumes?

2. **Science and Theater Meet Onstage...and in a Poster.** A **theatrical poster** is a form of graphic art which advertises a show or play and attempts to be evocative of the story, style, and mood of the play to attract an audience to buy tickets and attend the production. A **scientific poster** is a form of scientific literature that scientists use to introduce and communicate their research ideas, methods, and results at scientific meetings and conferences to colleagues in the field, students, and even laypersons.

- Have your students *cross-breed* a theatrical poster with a scientific poster to create an imaginative *hybrid* which reflects upon and communicates their personal experience of *The How and the Why* in performance.
- Encourage your students to include both facts and feelings—what they saw and what it meant to them, intellectually and emotionally—in text/words and images (i.e., from the play, found elsewhere or self-created.).
- To create their posters, students can utilize traditional/conventional art supplies/materials (i.e., paper and pen, paint, collage) or computer-generated means (i.e., PowerPoint, Adobe Illustrator, etc.) or a synthesis of the two.

- Once completed, students should be given time to show their finished works to the class and share their experience of *The How and the Why* through an explanation of their posters. Allow for discussion and engagement of ideas for each poster, and, if time permits, have the class select the most engaging and/or effective poster via anonymous secret ballot.
3. ***The How and the Why: The Review.*** Have your students take on the role of theater critic by writing a review of the McCarter Theatre production of *The How and the Why*. A theater critic or reviewer is essentially a “professional audience member,” whose job is to provide reportage of a play’s production and performance through active and descriptive language for a target audience of readers (e.g., their peers, their community, or those interested in the arts). Critics/reviewers analyze the theatrical event to provide a clearer understanding of the artistic ambitions and intentions of a play and its production; reviewers often ask themselves, “What is the playwright and this production attempting to do?” Finally, the critic offers personal judgment as to whether the artistic intentions of a production were achieved, effective, and worthwhile. Things to consider before writing:
1. Theater critics/reviewers should always back up their opinions with reasons, evidence, and details.
 2. The elements of production that can be discussed in a theatrical review are the play text or script (and its themes, plot, characters, etc.), scenic elements, costumes, lighting, sound, music, acting and direction (i.e., how all of these elements are put together). **[See the Theater Reviewer’s Checklist.]**
 3. Educators may want to provide their students with sample theater reviews from a variety of newspapers.
 4. Encourage your students to submit their reviews to the school newspaper for publication.
-

Special Events

The How and the Why In Conversation

McCarter Theatre invites you to join us on February 6th after the 2pm performance of *The How and the Why* for an intimate, engaging, and provocative discussion about big ideas in the play.

Moderated by acclaimed *New York Times* Science Writer, Gina Kolata, this round-table conversation will explore the many overlapping questions of gender, evolution, feminism, “adaptive stories,” and generation gaps in the fields of Biology, Gender Studies, and Theatre.

The How and the Why In Conversation:

Blazing Trails and Taking Names

February 6th – After the 2pm performance

Free and Open to the Public

Featuring:

Jill Dolan, Director of the Program in the Study of Women and Gender at Princeton University

Emily Mann, Artistic Director of McCarter Theatre Center and Director of *The How and the Why*

Franziska Michor, Professor of Biostatistics and Computational Biology at Harvard University and winner of the 2007 Dobzhansky Prize in Evolutionary Biology

Daniel Rubenstein, Chair of Princeton University’s Department of Ecology and Evolutionary Biology

Shirley Tilghman, Molecular Biologist and President of Princeton University

Moderated by Gina Kolata, *New York Times* Science and Health Writer

The McCarter “In Conversation” Series consists of symposium-style discussions among leading artists, scholars, and other public figures that foster cross-disciplinary exploration of big questions and concepts in McCarter’s plays. The Spring 2011 “In Conversation” Series is co-sponsored by Princeton University’s Program in the Study of Women and Gender.

Explore with us...

HOW might we learn about science from theater, and about theatre from science?

WHY are women’s bodies still a revolutionary subject of study in any field?

HOW did women blaze the professional trails in science and art that created space for the next generation?

WHY are women still underrepresented in senior positions in science and theater?

Coming Next:

Crimes of the Heart in Conversation: Women, Comedy, and the Legacy of Beth Henley
Sleeping Beauty Wakes in Conversation: Re-thinking the Princess in Fairy Tales and Musicals

Dialogue on Drama

A Discussion with Sarah Treem and Emily Mann
Sunday, January 16th (after the 2pm performance)

Dialogue on Drama is an in-depth post-show discussion focusing on the craft and artistry necessary to bring a play to life. Join Artistic Director Emily Mann and playwright Sarah Treem after the January 16th matinee performance for a conversation about Sarah's process as she wrote and developed *The How and the Why*. Hear about Sarah's inspiration for the play, what she's learned in the rehearsal process, and how she worked with Emily, the actors, scientific experts, and a dramaturg to revise throughout her time at McCarter. Sarah Treem will be available to sign your published copy of *The How and the Why* after this discussion.

Post-Show Discussions

Post-show Discussions at McCarter are highly interactive audience-based conversations facilitated by an artist from the production. These discussions focus on a range of topics including how artistic choices were made for the production, background information on the play, and reflections and questions from audience members.

Post-Show Discussions for *The How and the Why* will take place after the following performances:

Wednesday, January 19th – 8pm
Sunday, January 23rd – 2pm

Published Script

McCarter Theatre Center is proud to offer limited edition publications of select plays in the McCarter Theater Series. Each book published by McCarter offers our audiences the opportunity to continue their experience with a play and commemorates the memorable production that brought the play to life here at McCarter. McCarter is committed to discovering, developing and sharing important voices in playwriting. Now you can revisit these extraordinary new plays time and again as you build your collection of artfully designed McCarter publications.

The published script of *The How and the Why*, including letters from Sarah Treem and Emily Mann on the occasion of this world-premiere production, is available for purchase at McCarter's Company Store beginning January 14th.

Join us on January 16th for a book signing with Sarah Treem, author of *The How and the Why* after Dialogue on Drama. [DETAILS](#)

Site Credits

Venue: Berlind Theatre

AUDIENCE GUIDE STAFF

Editors: Paula Alekson, Carrie Hughes, Adam Immerwahr

Web Design: Dimple Parmar

Contributors: Erica Nagel, Emilia LaPenta