PJIM PARSONS JOURNAL FOR INFORMATION MAPPING

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Modeling and Assembling Visual Devices to Compare Stem Cell Processes

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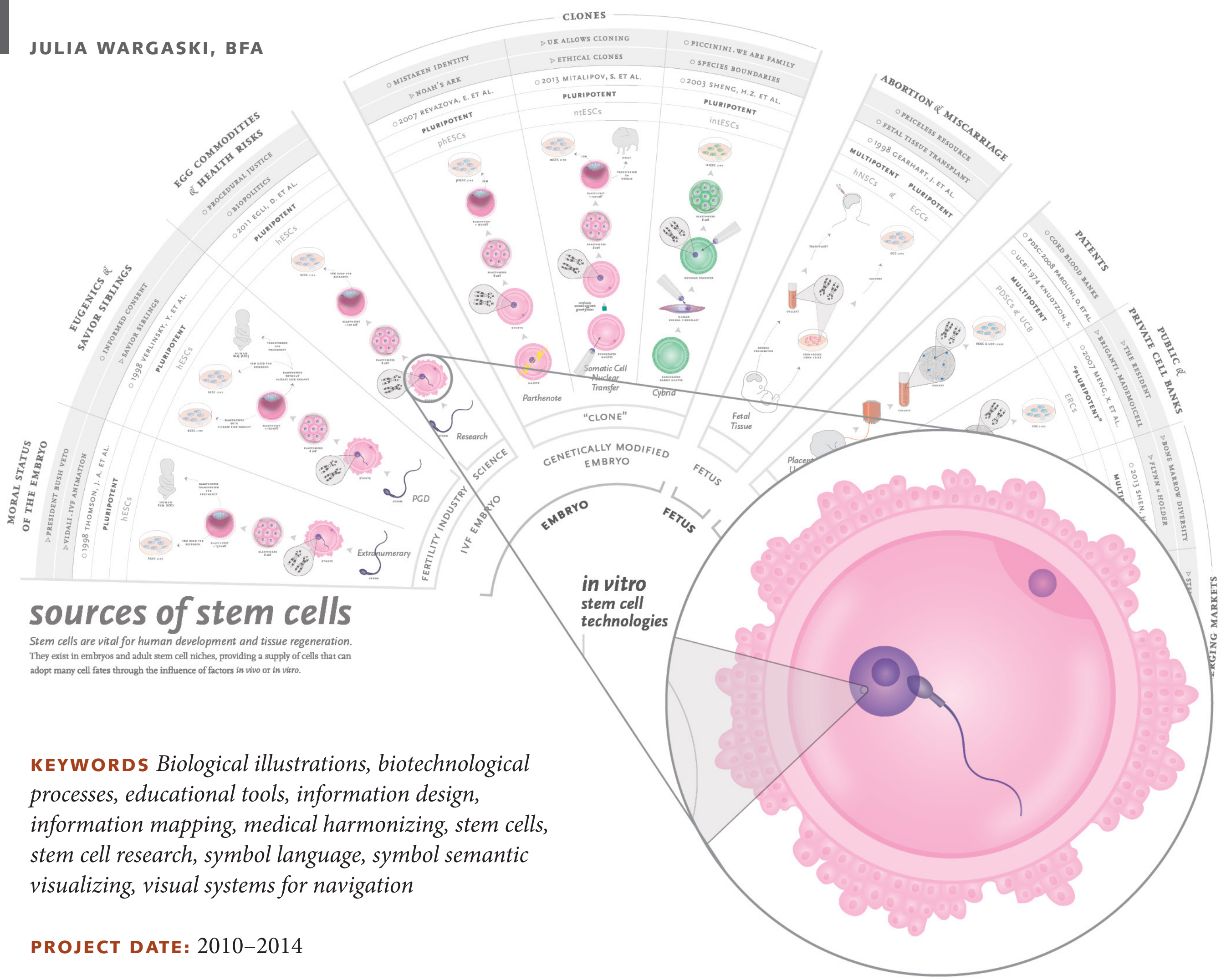


KEYWORDS *Biological illustrations, biotechnological processes, educational tools, information design, information mapping, medical harmonizing, stem cells, stem cell research, symbol language, symbol semantic visualizing, visual systems for navigation*

PROJECT DATE: 2010–2014

URL: www.stemcellcurriculum.org . 2014

FIGURE 1: *As art director, information designer and illustrator, Julia Wargaski collaborated with two biologists, content and content flow creators, Katayoun Chamany and Lianna Schwartz-Orbach, to co-create the Sources of Stem Cells Radial and the twelve related detailed sheets for the Stem Cells Across the Curriculum (SCAC) grant, funded by New York State Stem Cell Science (NYSTEM) and The New School. To access the original designs for the Sources of Stem Cells Radial and twelve related detailed sheets (detailed sheets potentially also called Zoomgraphics), and for details about collaborators, funders, permissions for use, and to watch the video walkthrough accompanying these designs please go to the SCAC website.*

ABSTRACT By designing with clarity and integrity, aesthetics and information can be effectively combined to inspire users to rapidly glean knowledge and understanding from complex subjects. By illuminating the functional truths between things, good design can empower others — of any age or origin — to discover solutions and yield the means to tenaciously resolve problems. These beliefs have sparked a shift in my practice within what I call "bedrock knowledge areas," and the communication systems to convey and publish these. As an educator, my goals are continually set on discovering and stretching each stu-

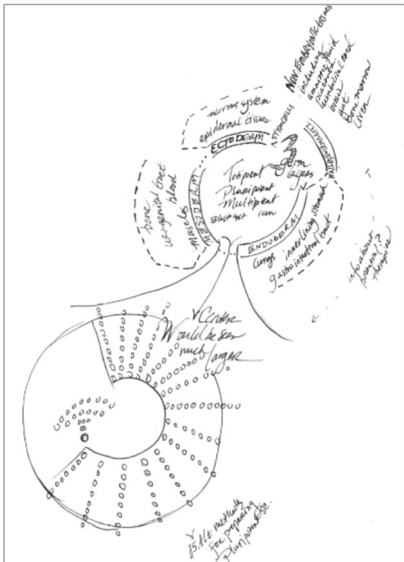
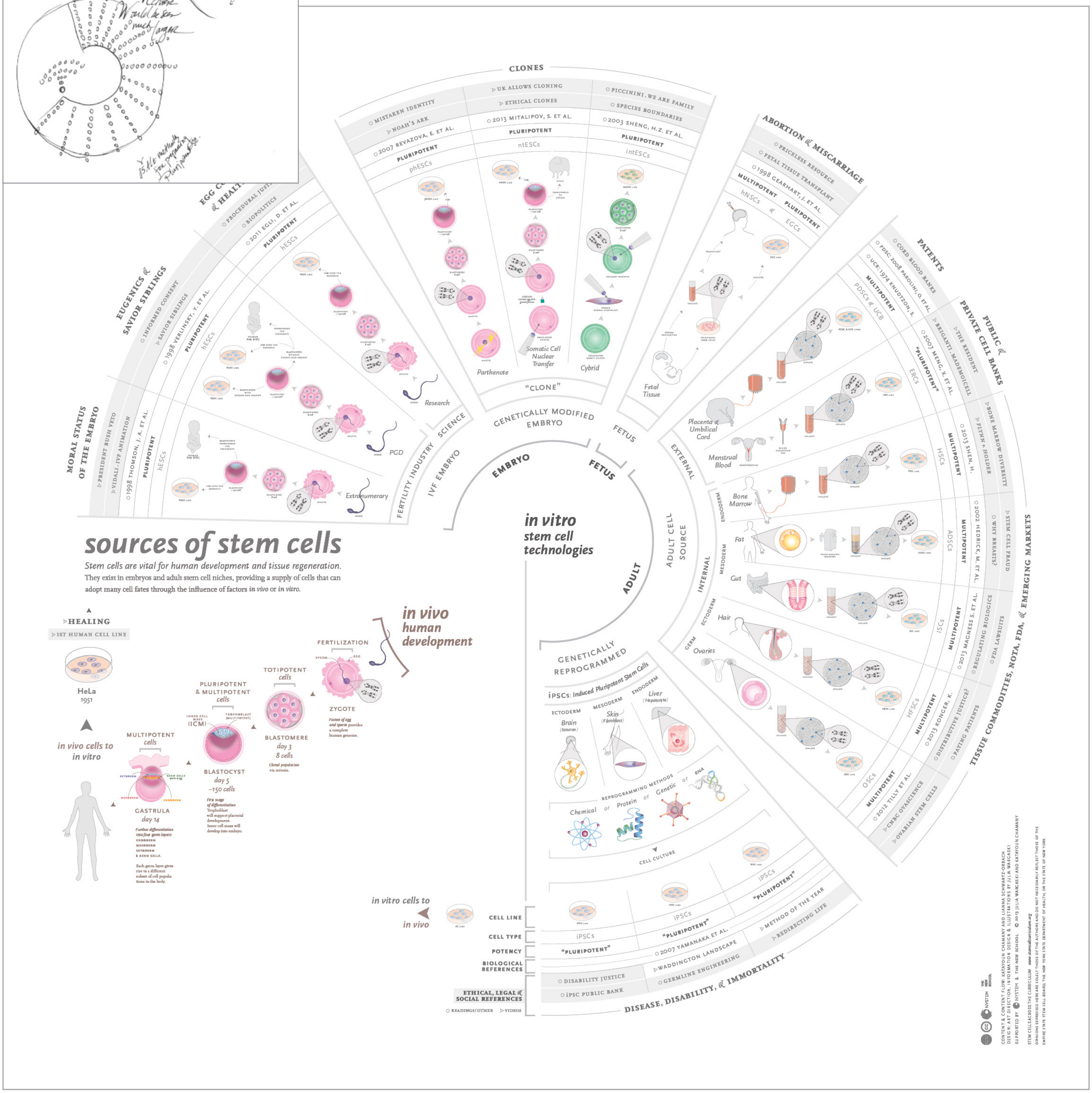


FIGURE 2: *At left: In my mind's eye, initial visions of design solutions happen in 3D, in motion and with interactivity and are then transformed into 2D stills. The strongest initial influence for this sketch was after immersion in some content that was also in SCAC's initial resources list. I proposed this mega cell visualization idea to the SCAC Team, on September 8 2010. Just the lower radial portion of this sketch was brought to fruition through collaborations with biologists Katayoun Chamany(PI) and Lianna Schwartz-Orbach which became the final design of the "Sources of Stem Cells" radial seen below.*



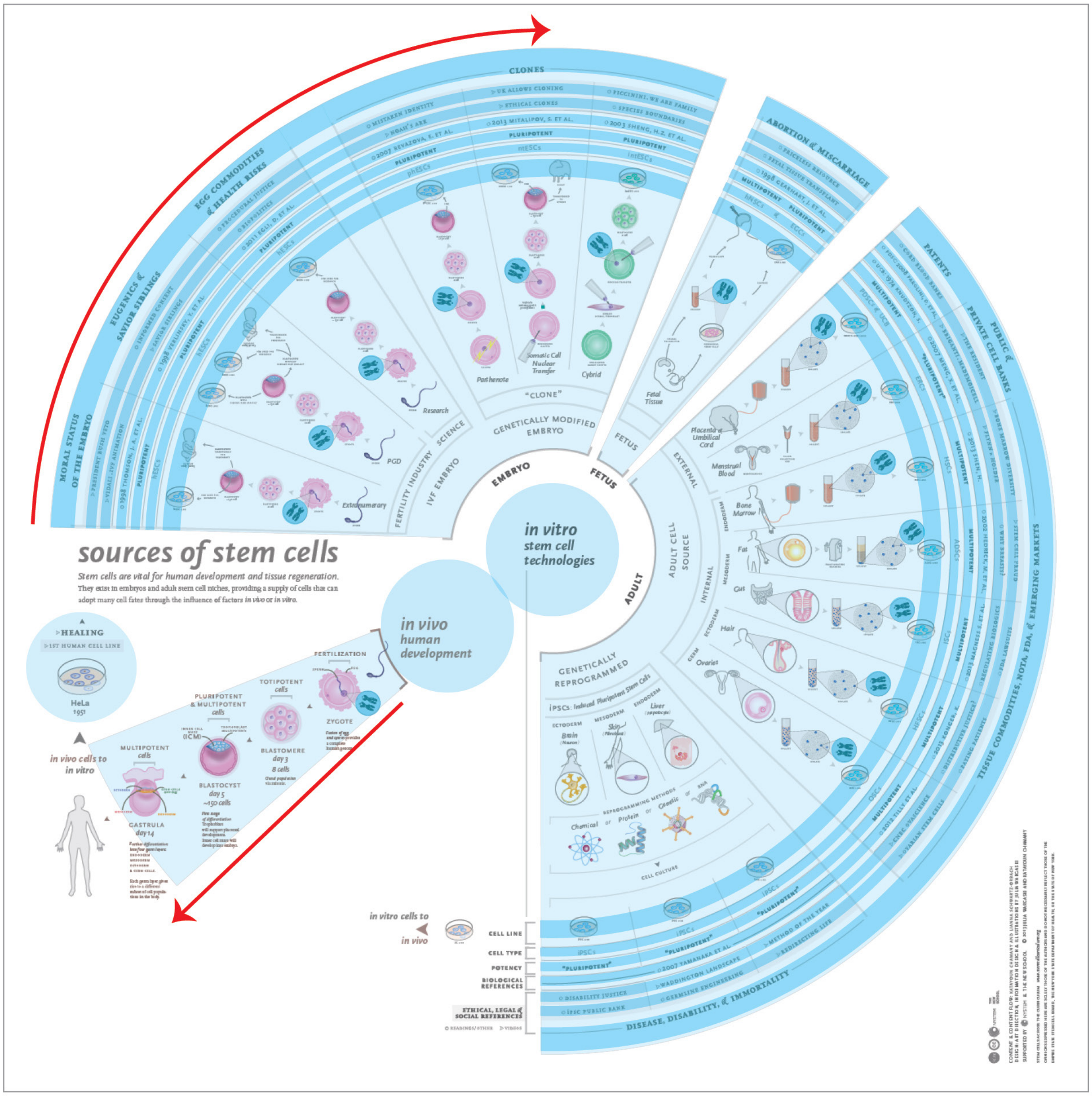


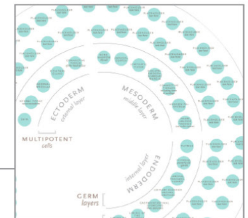
FIGURE 3: *Blue highlighted areas illuminate main categories of conceptual and navigational integrations.*

dent's highest abilities: adaptability, visual and intellectual acuity, design adeptness, and tenacity. I strive to provide an environment where choice and experimentation, through visualization modeling, will be the catalyst for these qualities to arise and be fulfilled. As one individual under a multifaceted collaborative group grant, Stem Cells Across the Curriculum (SCAC), there emerged an excellent opportunity to immerse myself in such bedrock knowledge — biological content. The designer's capability to dive deeply into ostensibly complex areas of science, and provide meaningful contribution through information design, is dependent on their capabilities in establishing hierarchies and taxonomies against the available resource and resultant modeling acumen. Developing effective educational tools, which will pass on key learning moments through the creation, integration, and balancing of these hierarchical systems, image assemblies, and typographical "shifts," is the objective. It is often an all-consuming endeavor, involving time and meticulous care that well exceeds available funding, yet becomes an investment in its own right. The objective must be to create visualizations that achieve the highest possible level, based upon all known research, which reveals an empowering insight into the context of the knowledge with a commensurate capability to understand the specific. With these kinds of objectives and methods at hand, a designer can create the single element (the grammar) that combines, through a highly structured semantic, to create visual intelligence that is at once specific and contextual. This paper follows a case study where single visual elements throughout are taken through highly structured iterations for "Sources of Stem Cells" diagrams and related compositionally detailed information sheets.

SOURCES OF STEM CELLS

I have included the core illustrations, and the logic under which these are created. Design, being spatial, allows us to look at the completed model, the "Sources of Stem Cells" radial, and understand how all the components build into a complex, but easily accessible construct. In this comprehensive radial diagram the two main categories of "*in vivo*" and "*in vitro*" are centrally located (see FIGURE 3). Fueled by my inspiration from the first split of a cell, the concept of splitting is depicted as the categorical "split" at the center. As you move down through Human Development, in vivo, you reach the human body and above you see a dish labeled "HeLa 1951." Moving up and around you encounter stem cell processes in vitro following along human growth from "Embryo" to "Fetus" to "Adult." Moving out from the center, via concentric circles of expansion, are cell processes, genetic information, cell line, cell type, potency, biological references, as well as ethical, legal, and social references; these are further supported by overarching ethical issues. References for each process, which are divided into the two main categories, "Biological References" and "Ethical, Legal and Social References," are seen in the outer rings. Each has a clickable circle representing "Readings/Other" or a clickable arrow representing "Videos" which takes you directly to that resource online. The work was primarily designed to be viewed digitally, through crisp and clear PDFs. Thus, the ability to zoom into the illustrations, and thereby move in and out of cells would be provided; this was then supplemented by typographical elements whereby selection would access relevant online resources. The twelve detailed sheets, which were then termed "ZoomGraphic," would facilitate the unpacking of requisite detail. Most of the processes shown in the "Sources of Stem Cells" radial, and the radial itself, are not merely stand alone designs. Their efficacy is connected to, and understood more fully, when seen in connection with the team's other materials. Of particu-

FIGURE 4: *An idea I had before the grant started which was not able to be realized through the SCAC grant work and is seen in the center of my sketch presented on September 8, 2010. This visualization would show germ layers and differentiated cells. The cells would be clickable illustrations taking you to cell images and resources online related to that cell. It would be exciting to visualize this idea of differentiation of all cells at some point in the future.*



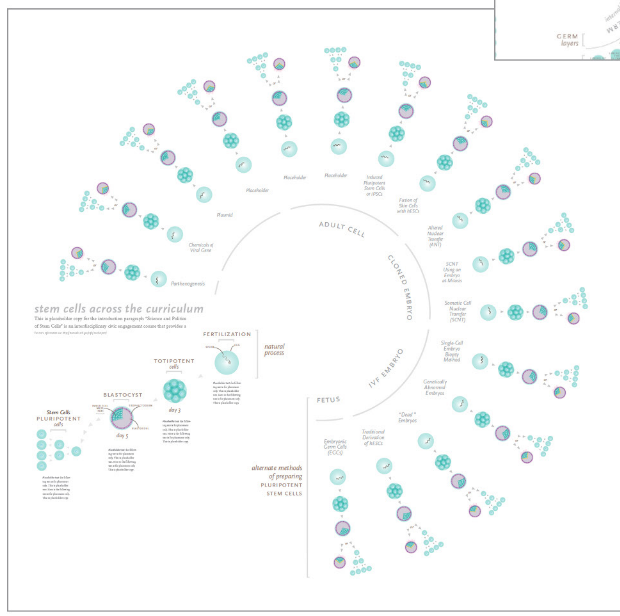
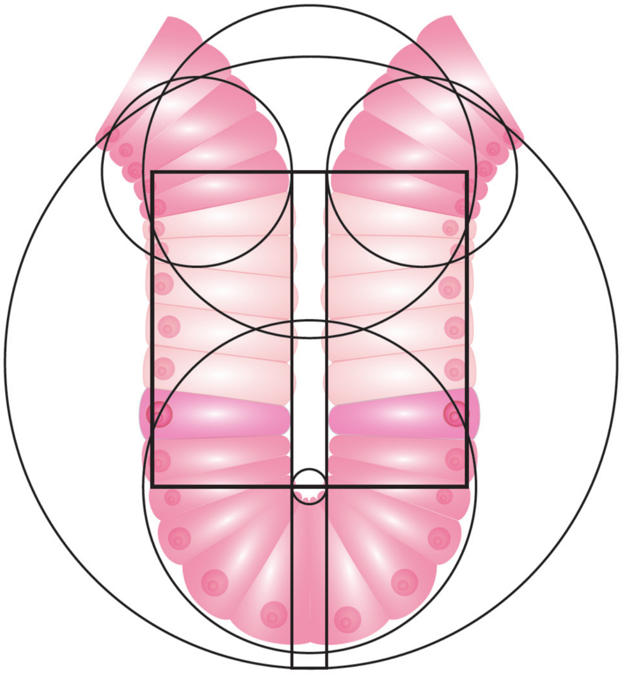


FIGURE 5: *An initial rough version of the "Sources of Stem Cells," one among a few ideas I presented to the SCAC team and which were then included in the SCAC team's presentation at "NYSTEM 2011: Science Accelerating Therapies", the educational session, at the CUNY Graduate Center on May 24, 2011.*

FIGURE 6: *Work from content immersion and sketching sessions with biologists Katayoun Chamany and Lianna Schwartz-Orbach placed over another radial iteration, which included further detail in outer rings, of the proposed initial rough radial design seen in* FIGURE 5.



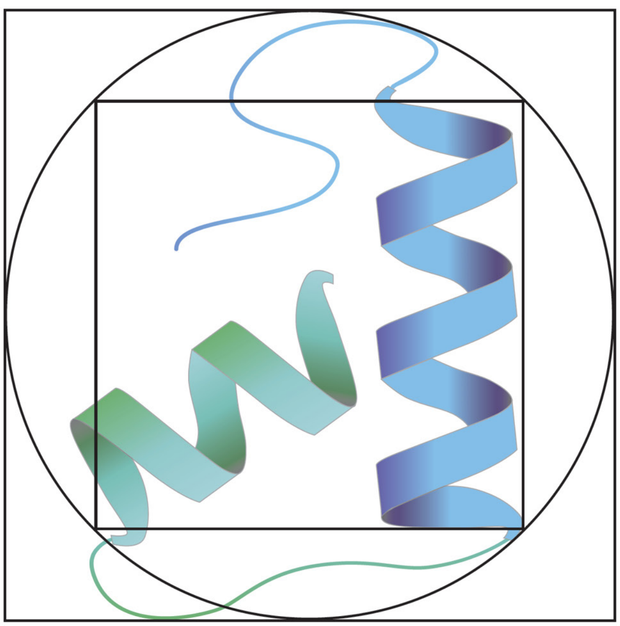


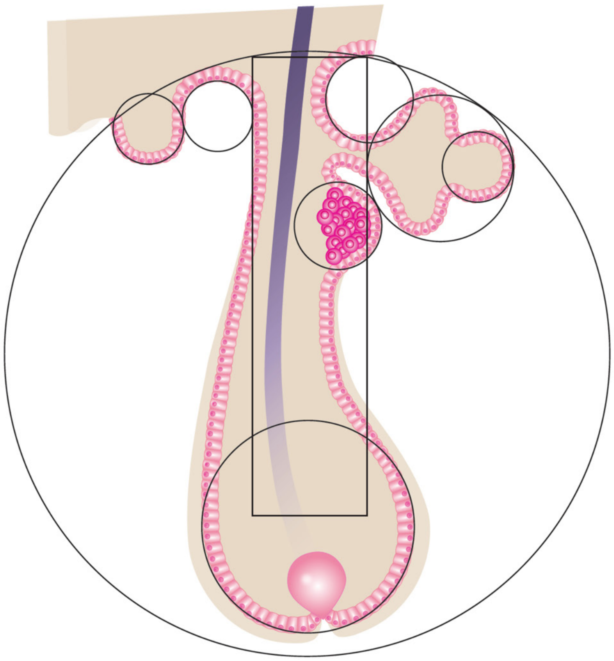
FIGURE 7A: *Structures for layered illustrative integrations are balanced mostly through simple systems of circles and squares. Each loosely occupying a unit of circle or square to create, when placed next to each other, a synergy through interstitial balance when see as a whole. Where possible, representations were simplified to essential aspects. The goal was to remove unnecessary noise and still be able to integrate more and more visual elements while still maintaining a balanced tug on the eye.*

lar importance is the initial viewing of the "Sources of Stem Cells" video, a walkthrough available on the SCAC website. Similar to my blue highlighted version, this video walkthrough, which Katayoun Chamany and other team members have created, will also give details for how case studies map to the radial. The point is that varying media sources, used in conjunction with each other, build the greater picture of familiarization. The video is an excellent window into the composed visualizations — conversely, core portions of detailed sheets were integrated into portions of some animated PowerPoint presentations. Together, the visual tools leverage the curriculum.

EARLY STAGES, INFO GATHERING & PROCESS

Because the project spanned several years, this overview is necessarily cursory. The descriptions and visuals associated with the process embody only the broad strokes of conceptual design factors I developed in order to "solve" for the visualizations that emerged from the undertaking. The process of creating the taxonomy and hierarchies to render the bedrock knowledge can be deductively understood through the thirteen visualizations. As is generally the case with effective designs it appears self-evident after the visual language has been constructed and the visual devices are appropriately deployed within that language. Successful design teams (composed of designers and subject experts) must be ever mindful that the pre-visual endeavors for creating an effective matrix is often a major part of the entire effort. The SCAC grant from New York Stem Cell Science (NYSTEM) was awarded from July 2010 – July 2012 (the team was granted a one-year, no-cost extension), this was then supplemented by an award from the Innovations in Education fund from the New School. Numerous, and quite lengthy phases, were involved in obtaining relevant information from the subject-expert biologists, Katayoun Chamany and Lianna Schwartz-Orbach. Ultimately, this allowed the comprehensive build-out the proposed "Sources of Stem Cells" radial.

Choosing Scala as the typeface was one of the least difficult tasks. My initial tests revealed that it supported hierarchical efficacy, navigability, and readability throughout multiple layers of complexity. In short, it brought clarity to the challenge of multiple textual layers. Typographical design played a role as did type color. Elements seen in brown are related to *in vivo* processes and typographical elements seen in gray are related to *in vitro* processes. Design process was not influenced by adopting previously established systems and methods, but design choices were instead driven by facets of immersion in



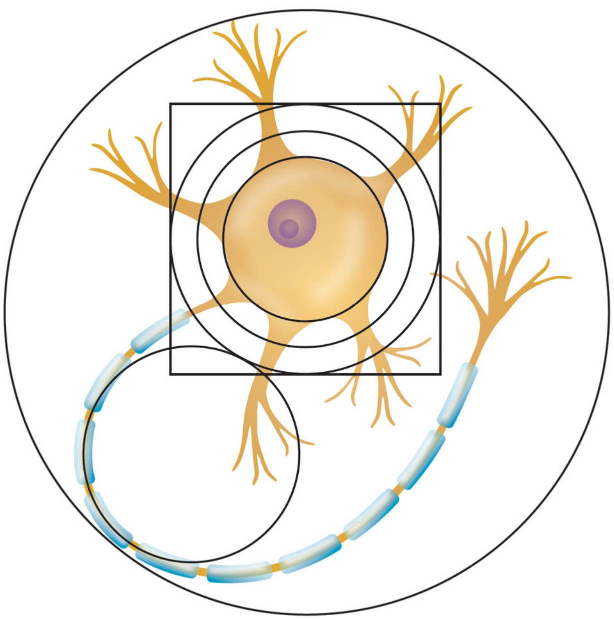


FIGURE 7B: *To prevent static forms with symmetrical geometric shapes in illustrations, some organic forms and lines were integrated freehand to emulate the seeming randomness of nature. Instead of using equidistant measures of space, the majority of illustrations and typographical elements were integrated into larger designs through visual instinct while sizing and moving parts in small increments until they clicked into place optically and reduced noise. Illustrating and integrating all of these interpretations unearthed my excitement and love of this kind biological visualization work — each one like a project.*

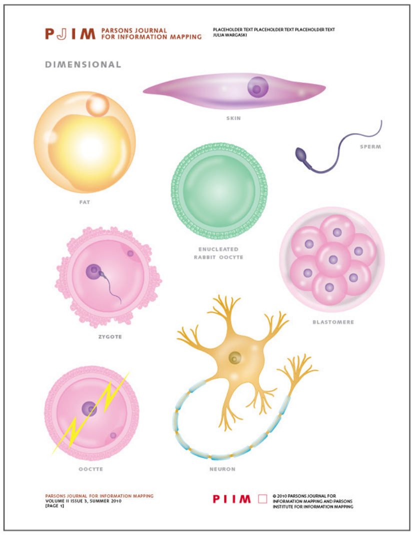
biological content and design instinct with information design as educational tools as the guiding force. Sometimes, as designers, our ability to work in non-linear ways with overwhelming amounts of information, our capacity to become immersed in the content, and our drive to materialize solutions to visualizations of the big picture is not entirely understood and we assume others will be as comfortable and as excited as we are with the complexity and durability of proposed design solutions. Additionally, during this complex and long process, what I considered experimental test visuals and internal rough work in progress phases, and labeled as such, others would see as completed solutions so clarifying and restating work in progress phases and process was necessary. After years of effort involving information gathering, changes in content flow, numerous additional content integrations, internal testing and collaborative challenges, the core systems of the designs remained largely the same.

DIMENSIONAL, FLAT & DIMENSIONAL/FLAT HYBRIDS

Visual elements for illustrations in biological processes break down into loose categories with some obvious overlap. The intent behind creating dimensional, flat, and dimensional/flat hybrid representations of cells structures and processes was to allow for different assimilation speeds when navigating and zooming in on the designs. These different treatments are meant to foster entrance into the design at multiple entry points and the capacity for knowledge to be gleaned from just one micro zoom in or a wide view of all spokes and their interrelatedness across all categories with more ease. Colors were deliberately applied to push forward in less saturated combinations and frequently with lower levels of contrast. The intention was to create less noise and allow the user to have more visual bandwidth remaining for assimilation of typographical elements and relevant connections across different categories of information narratives.

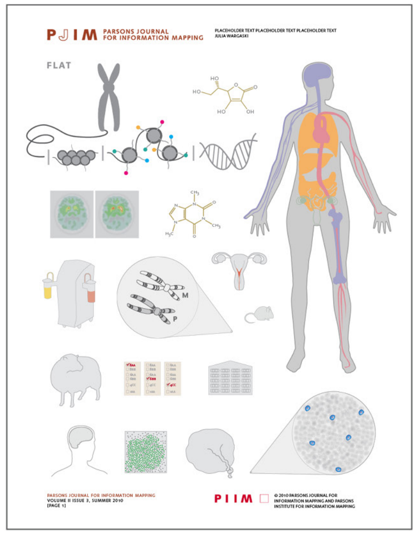
KNOWLEDGE BUILDING

An exciting aspect of the “Sources of Stem Cells” radial and twelve related detailed sheets is that they are free and accessible to the public for non-commercial projects, particularly in education. As long as one abides by the “Permissions for Use” (see website), one could build on the designs for educational and non-commercial purposes. Someone could download the PDFs, open them up in Adobe Illustrator, select an illustration, and visualize a better cell. Researchers could use parts of the design or fill it with their own processes to help them present their own findings and, in turn, others could build on that work



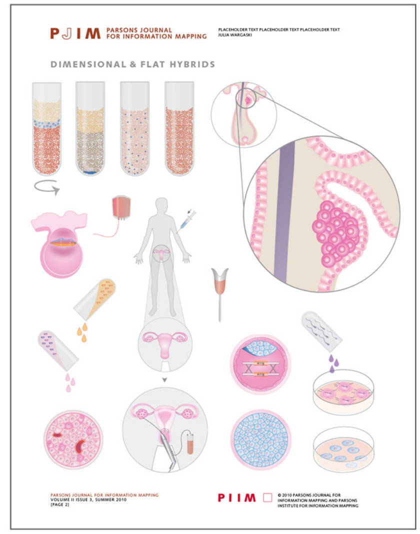
DIMENSIONAL

FIGURE 8A: *Dimensional Category for illustrative elements. See pages 8 - 9*



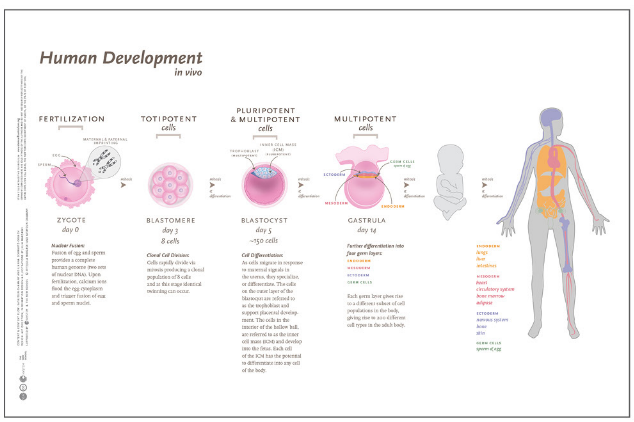
FLAT

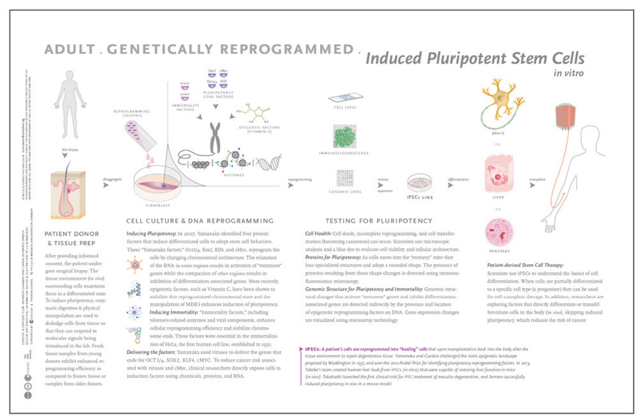
FIGURE 8B: *Flat Category for illustrative elements. See page 10*



DIMENSIONAL & FLAT HYBRIDS

FIGURE 8C: *Dimensional & Flat Category for illustrative elements. See page 11*



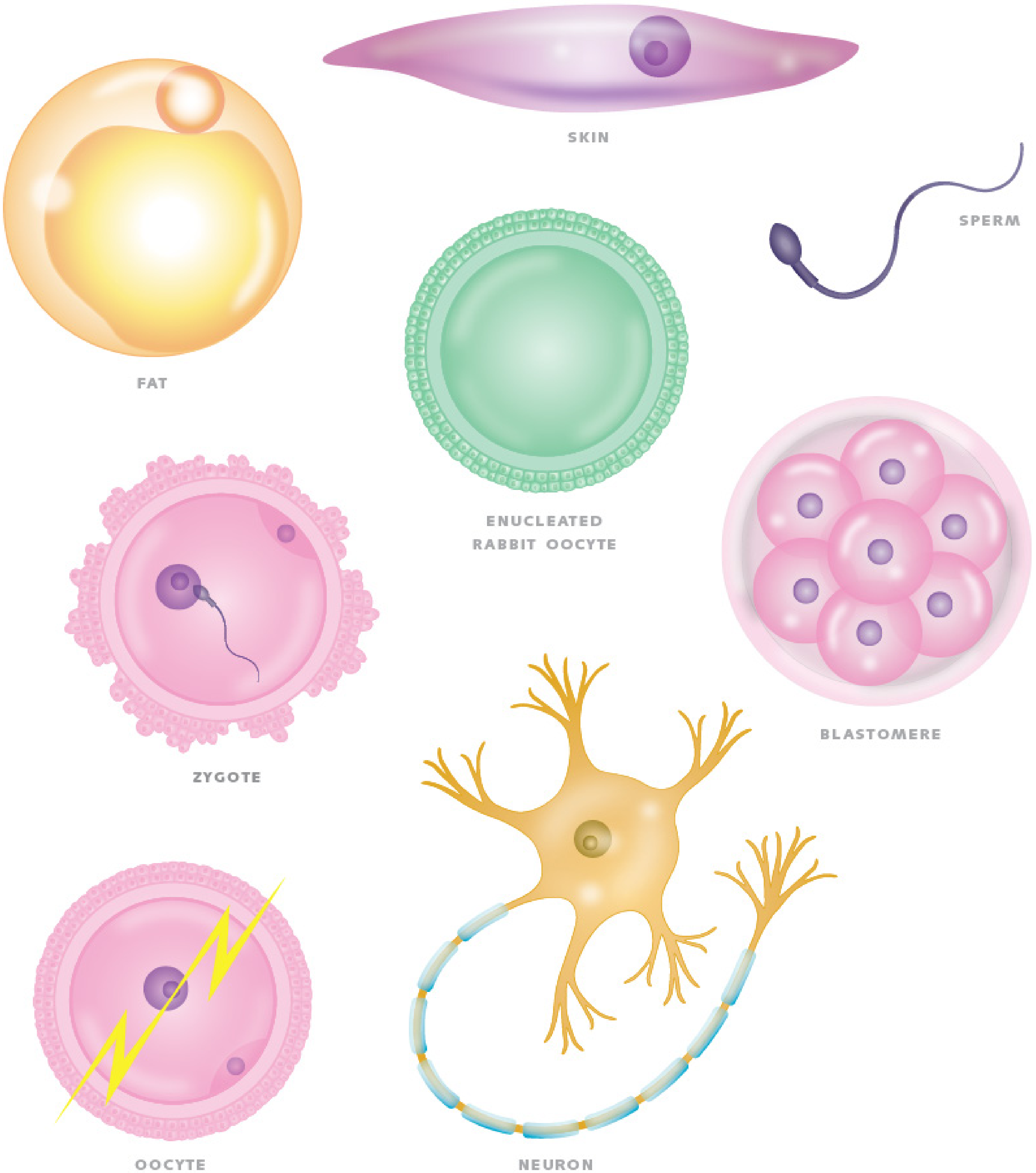


DETAILED SHEETS: ZOOMGRAPHICS

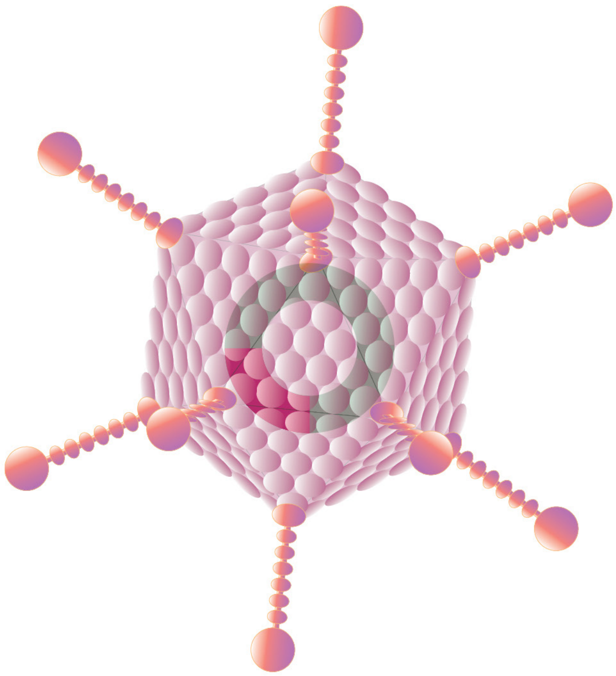
FIGURE 8D: *Set of Twelve Detailed Sheets: ZoomGraphics. [See pages 12 - 15.] Some selected sheets are enlarged out of sequence for expanded view of more complex samples.*

(see "Permissions for Use" language on the SCAC website). Even though the files for the radial and twelve detailed sheets were not initially organized for on-the-spot disaggregation purposes, anyone who is well-versed in Adobe Illustrator could access the original designs which will continue to live on the SCAC website in their original form. This kind of inclusion, meaningful sharing, and knowledge building, not just with small selected groups but with the entire world and for free, is inspiring to me — my long standing excitement and fascination with systems in nature and biology fuels inspiration for future endeavors.

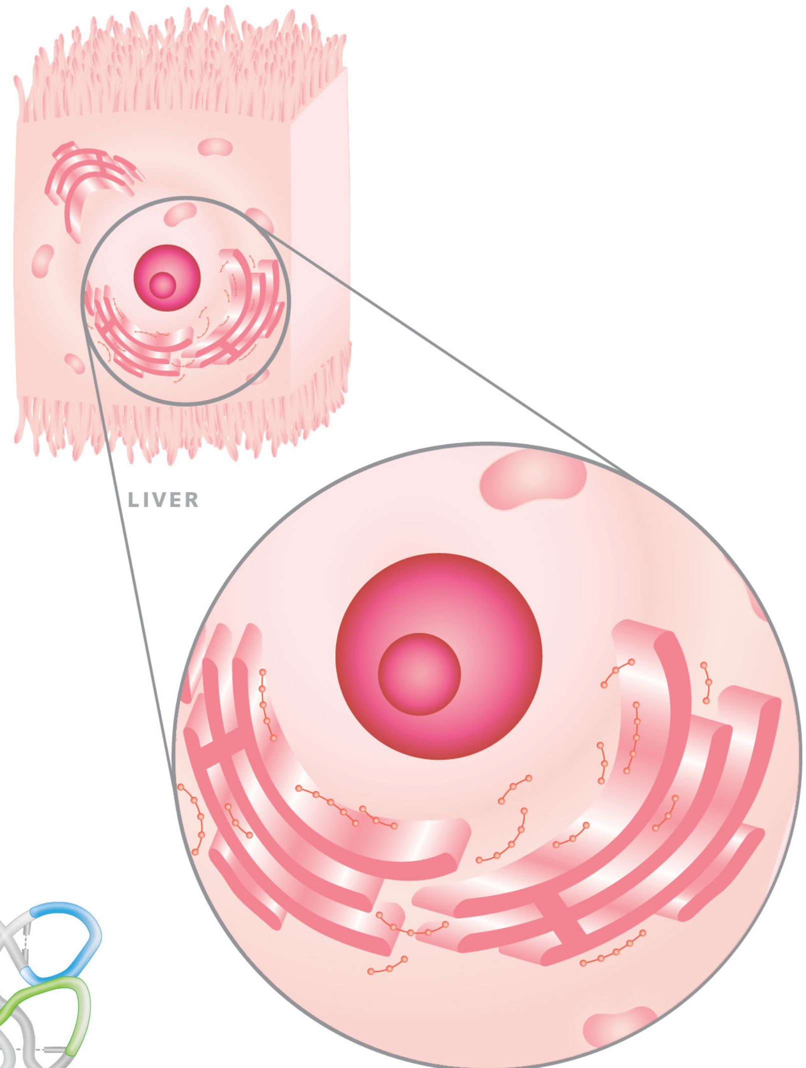
DIMENSIONAL



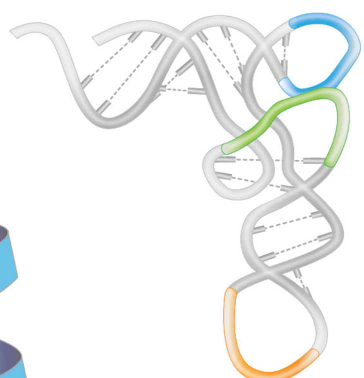
DIMENSIONAL



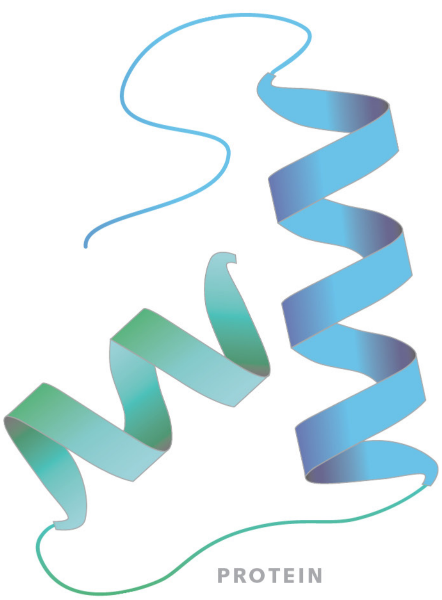
ADENOVIRUS



LIVER

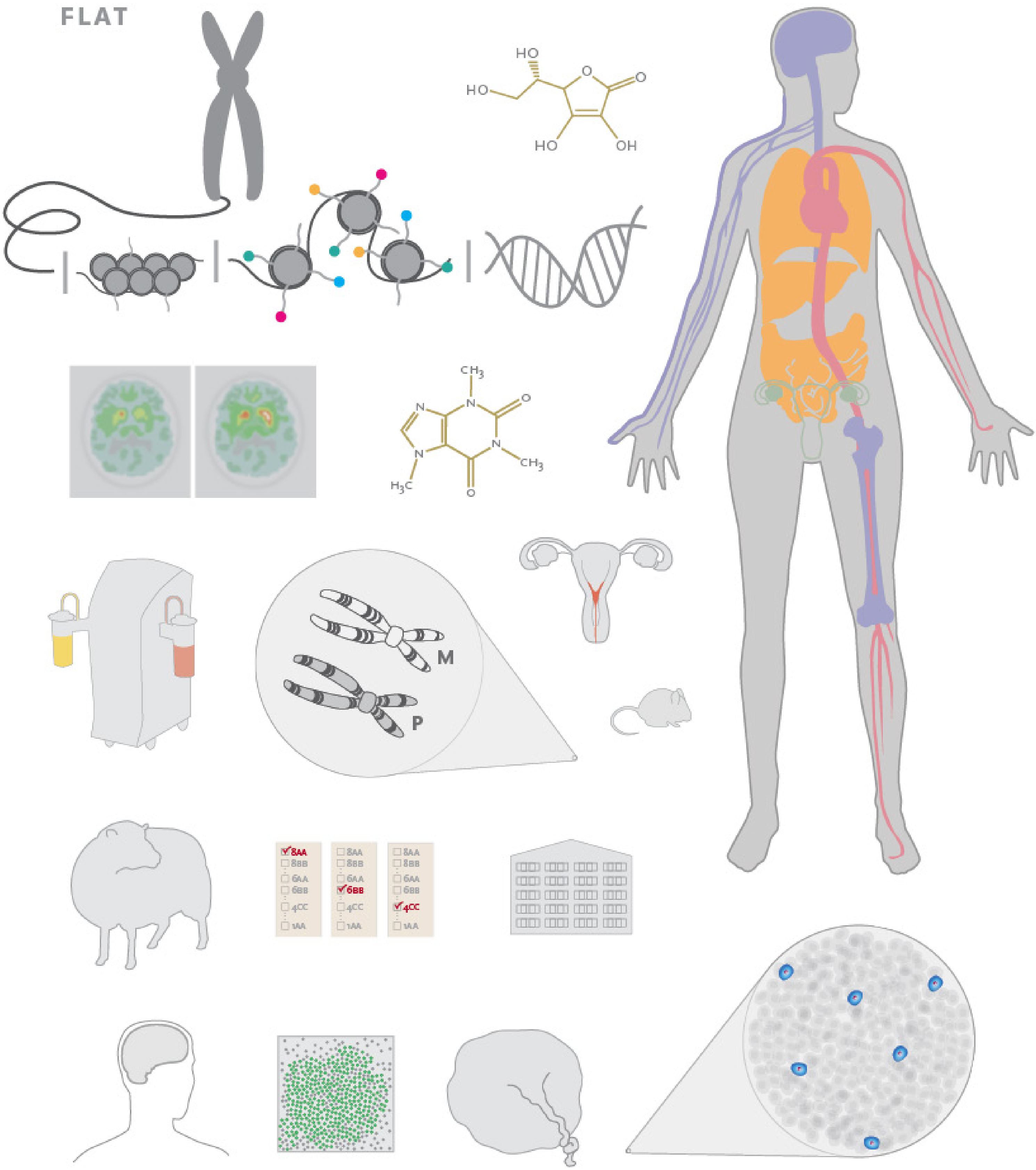


RNA



PROTEIN

GUT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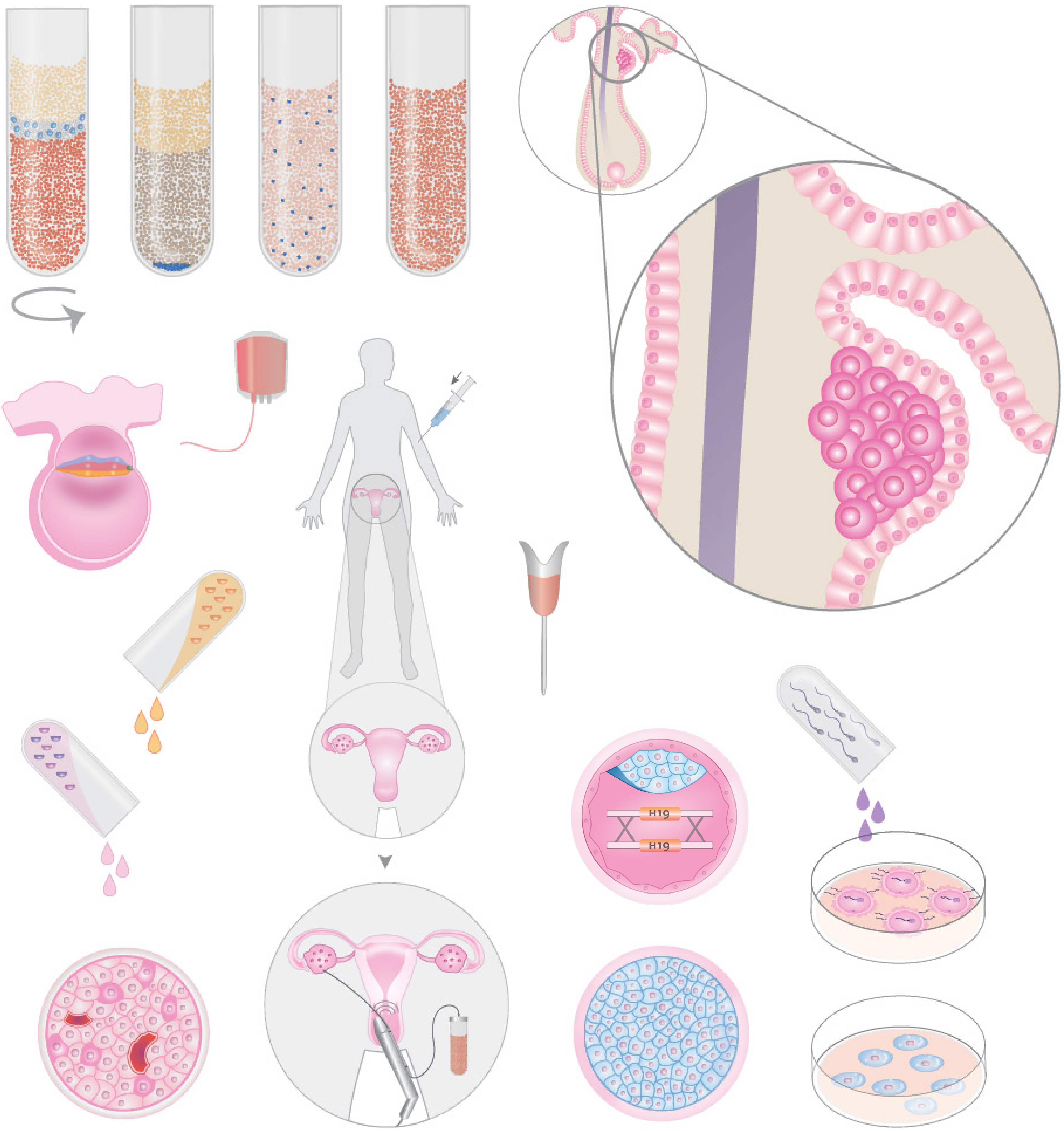
DIMENSIONAL & FLAT HYBRIDS



DETAILED SHEETS: ZOOMGRAPHICS

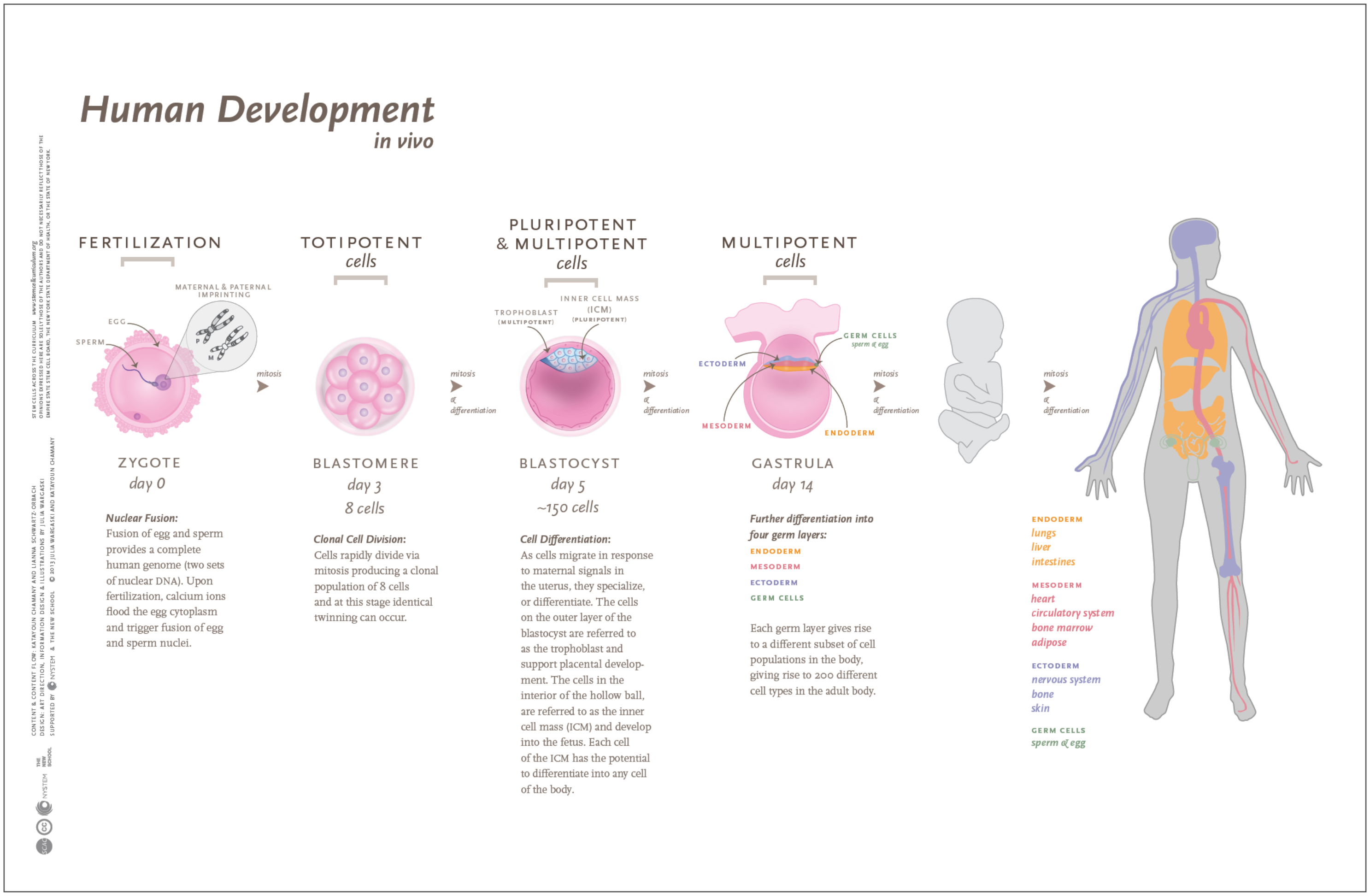


FIGURE 9A: *Human Development*

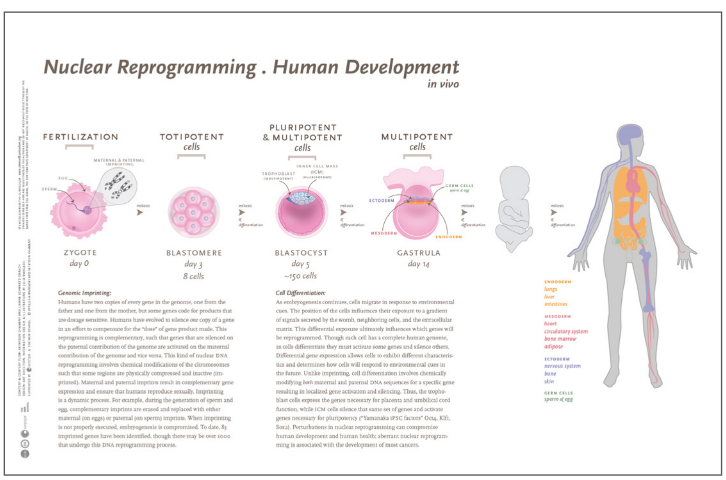


FIGURE 9B: *Nuclear Reprogramming/Human Development*

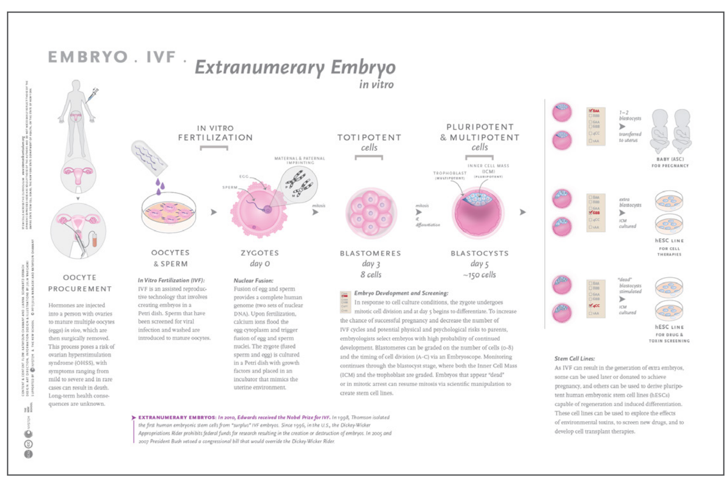


FIGURE 9C: *Extranumerary Embryo*

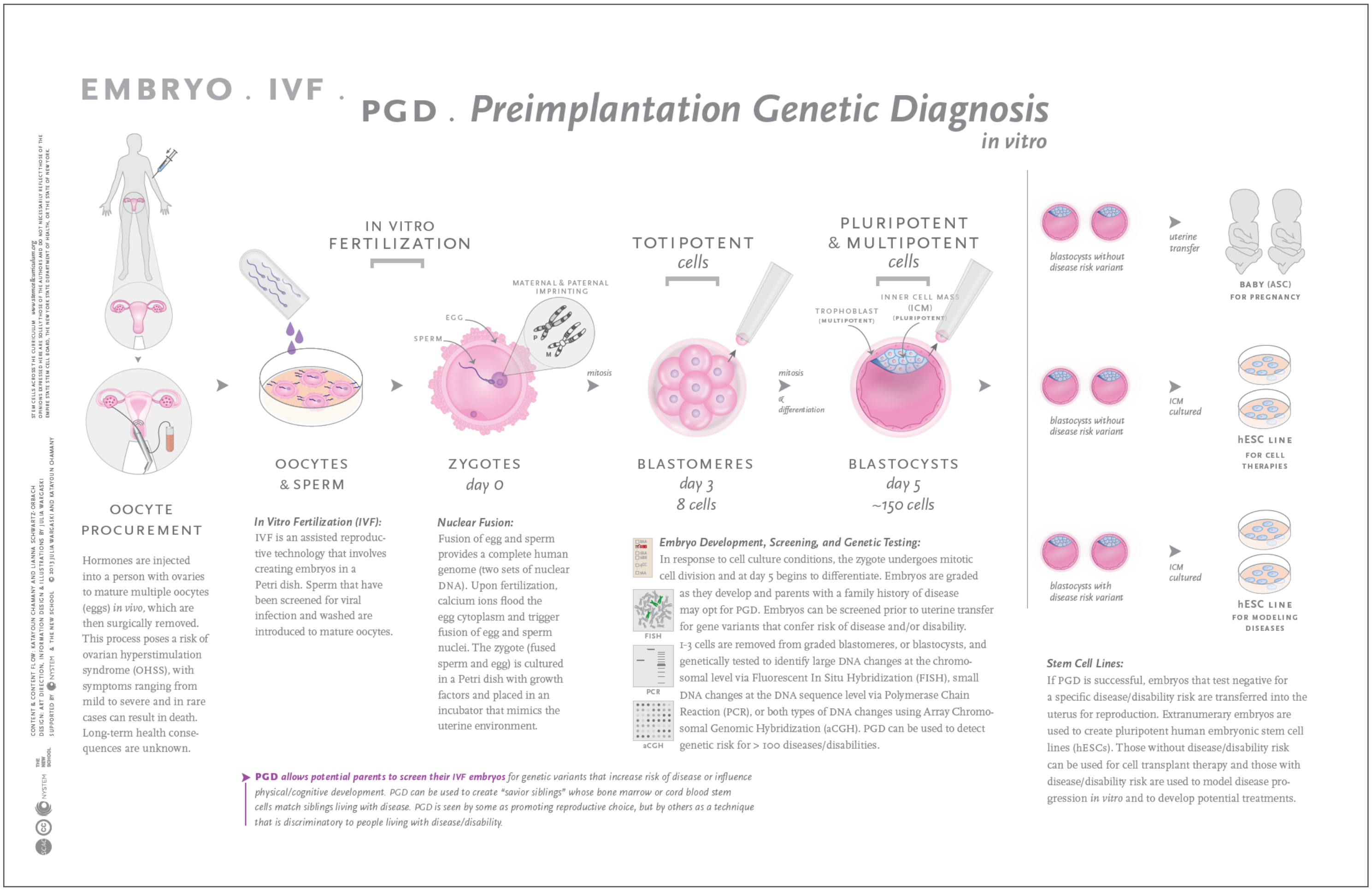


FIGURE 9D: *PGD: Preimplantation Genetic Diagnosis*

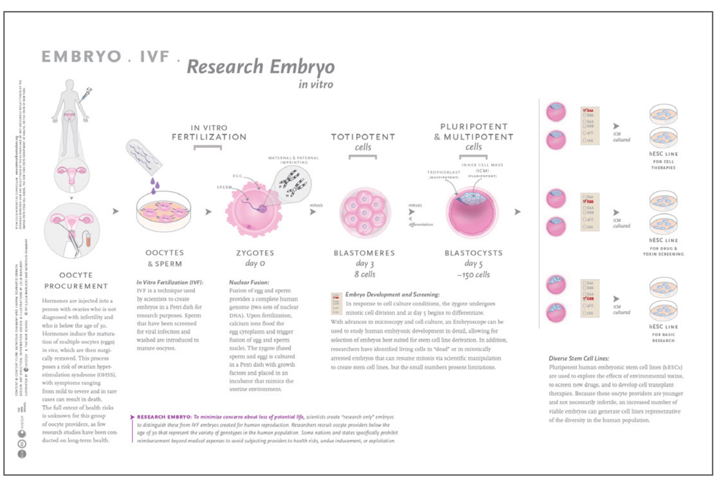


FIGURE 9E: *Research Embryo*

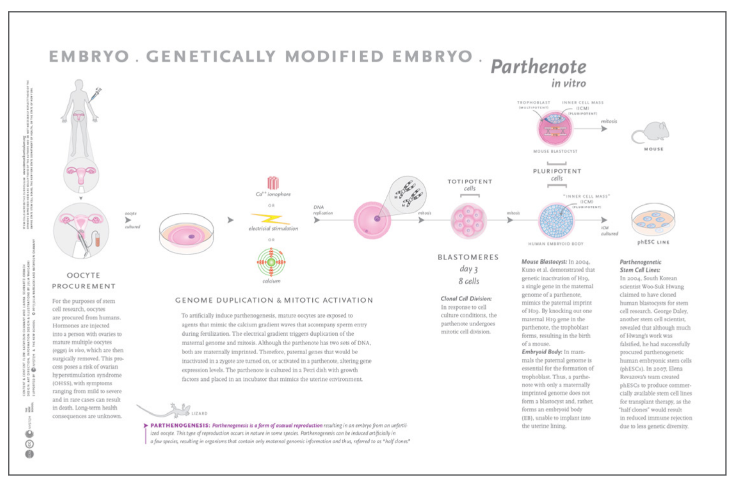


FIGURE 9F: *Parthenote*

P I I M

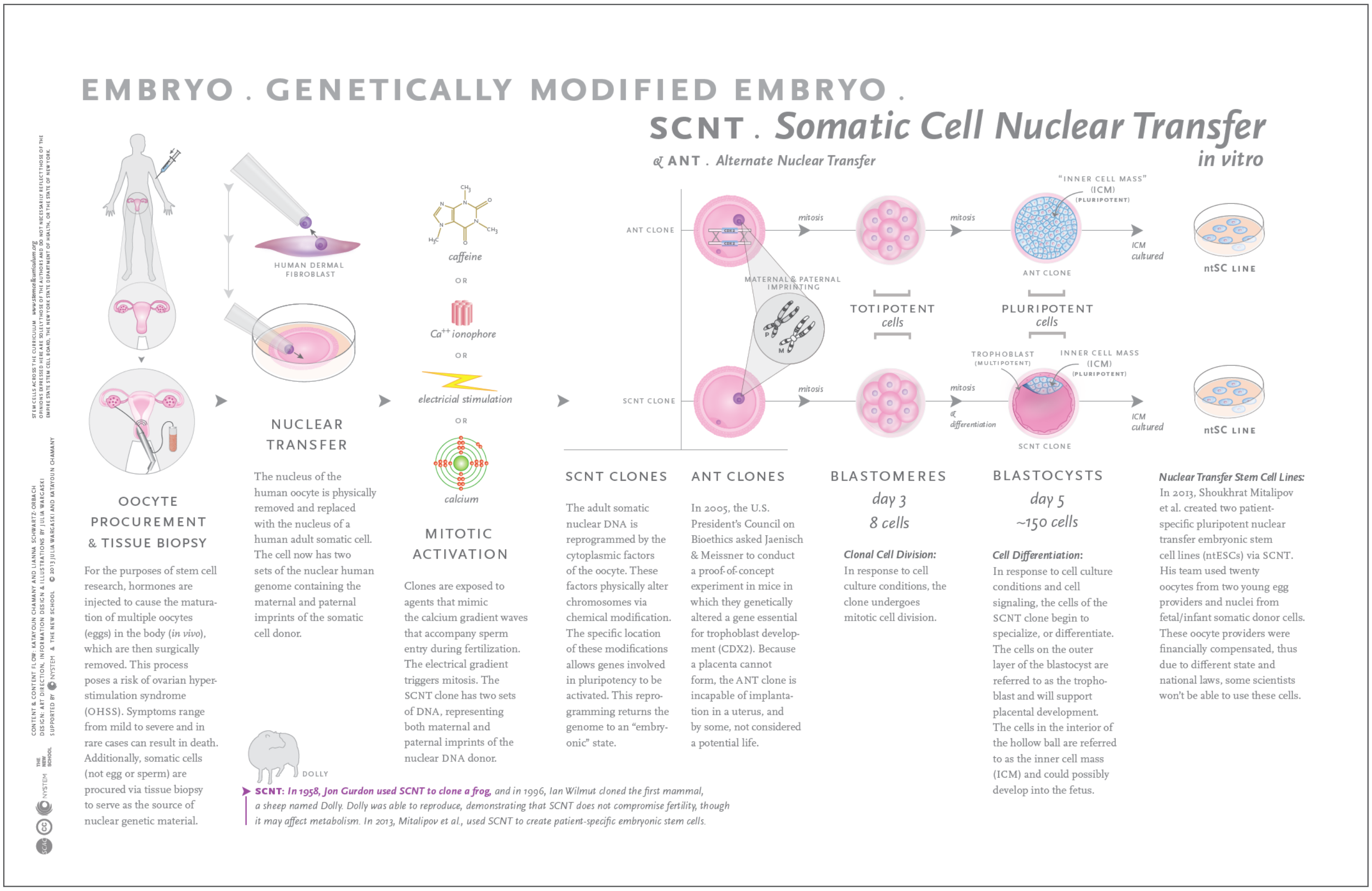


FIGURE 9G: *SCNT: Somatic Cell Nuclear Transfer*

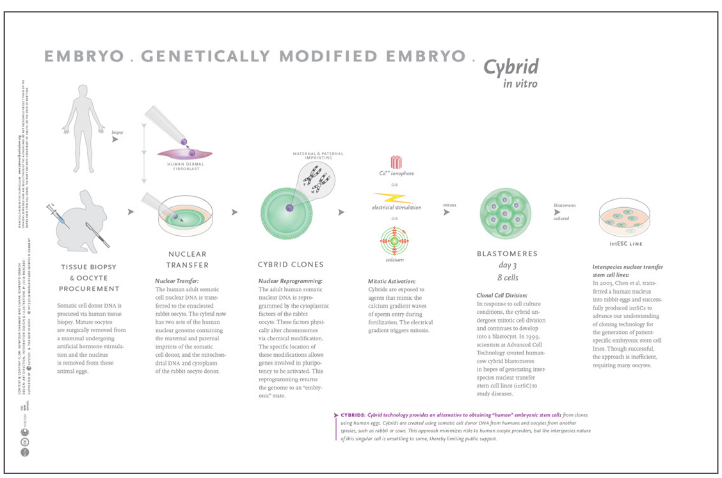


FIGURE 9H: *Cybrid*

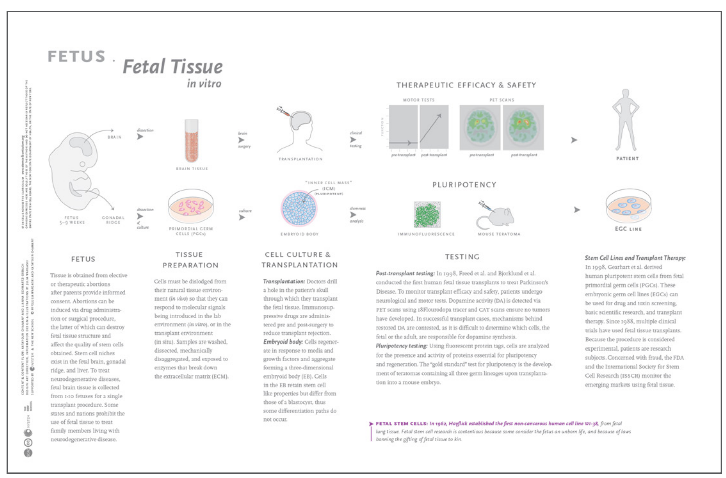


FIGURE 9I: *Fetal Tissue*

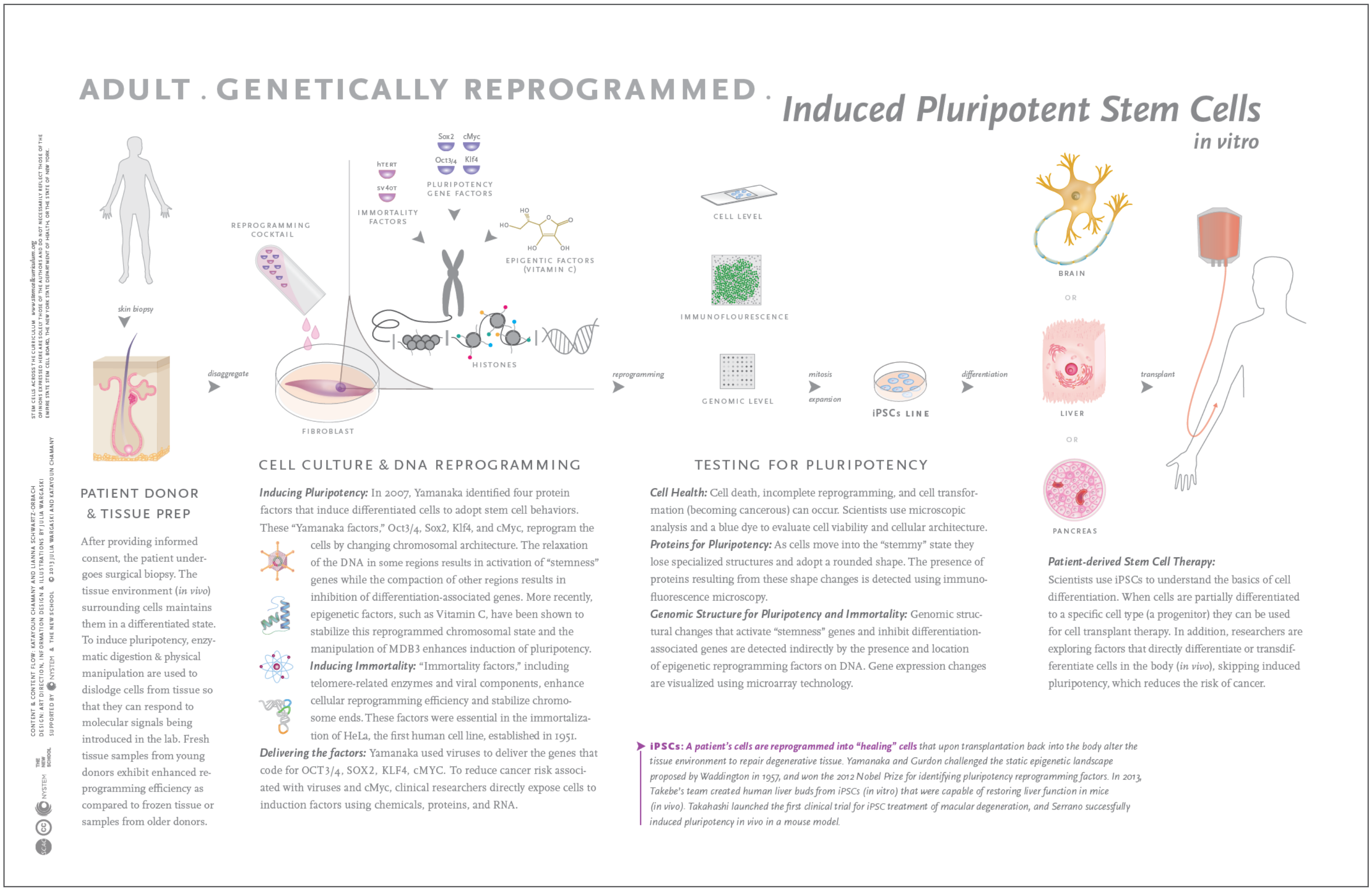


FIGURE 9J: *Induced Pluripotent Stem Cells*

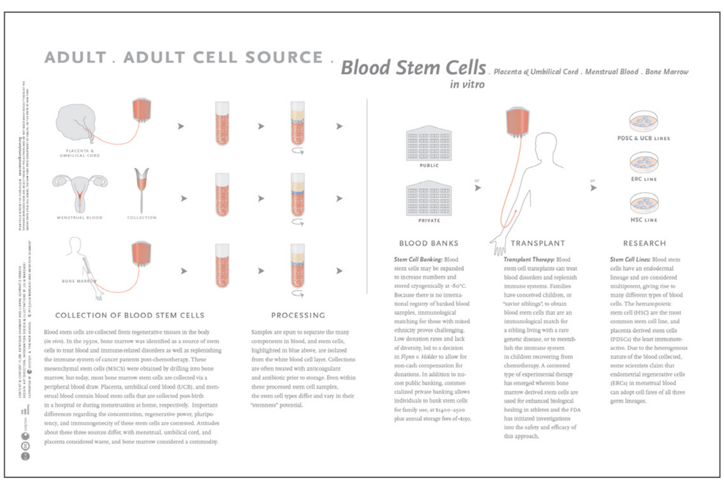


FIGURE 9K: *Blood Stem Cells*

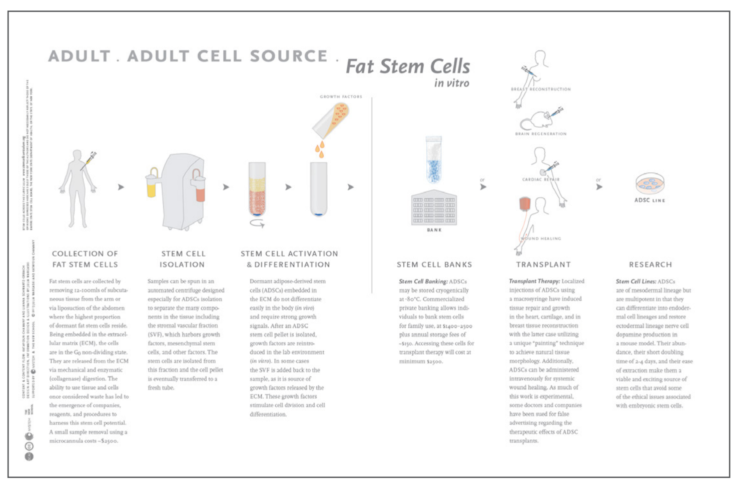


FIGURE 9L: *Fat Stem Cells*

BIOGRAPHY

Julia Wargaski is an Assistant Professor of Communication Design at *Parsons School of Design* within The School of Art, Media and Technology. Her specialization is in information design and design processes. As Art Director, Information Designer, and Illustrator, Julia collaborated with Katayoun Chamany and Lianna Schwartz-Orbach, two biologists/content and content flow creators, to co-create the Sources of Stem Cells Radial Infographic and twelve related ZoomGraphics (Detailed Sheets). Julia transformed biotechnological processes associated with stem cell research into intuitive information design narratives that highlight the provenance, manipulation, and use of each stem cell type and its associated therapeutic and scientific potential — information design as educational tools. She contributed Art Direction, Design and Co-development of educational materials for Princeton Nonviolent Communication (NVC) and Application, Information and Visual design for the Ripple, Explore and Map views for the Shape of Change online archive in collaboration with Director Melanie Crean. She was Co-author, Art Director, and Information Designer for development of the "Trees of Trade: Biodiversity and Extinction" educational game interface visualizations and transitions showing progression of information design narratives and how to 'play' the data, based off of Katharina Seifert's "Effects of Trade: Endangered Species of the Atlantic Rainforest," and in collaboration with Katharina Seifert, Preethi Chethan and Mike Edwards — in conjunction with the Data-play/Parsons PETLab. In addition to teaching multiple levels of information and undertaking research projects, Ms Wargaski pursues commercial programs and multiple practical applications, including Information Design & User Experience Design hybrid investigations — UX/UI. Ms Wargaski holds a BFA in Communication Design from Parsons School of Design and was educated as a User Experience Designer through General Assembly's NYC User Experience Design Immersive.