

"The Multi-Dimensional Human Embryo" [1]

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The [Multi-Dimensional Human Embryo](#) [3] website (<http://embryo.soad.umich.edu/> [4]) is a publicly accessible online database of the first three-dimensional images and animations of human embryos during different stages of development. Both the images and animations were created using magnetic resonance [microscopy](#) [5] and compiled for easy access. The virtual collection of images is the result of a collaborative project between the [University of Michigan](#) [6], the Center for *In Vivo* Microscopy at the Duke University Medical Center, and the Human Developmental Anatomy Center at the [National Museum of Health and Medicine](#) [7]. The project was funded by the National Institutes of Child Health and Human Development (NICHD) [The Multi-Dimensional Human Embryo](#) [3] is the first comprehensive collection of its kind, both in scope, [organization](#) [8], and the 3D nature of the images.

"The Multi-Dimensional Human Embryo" was completed in June 2001 after five years of development at the Center for *In Vivo* Microscopy at Duke University Medical Center as well as the [University of Michigan](#) [6]. The online collection consists of images and animations of human embryos in Carnegie stages 13 through 23. Embryological development is categorized by 23 total Carnegie stages, with stage 23 being the final stage before an embryo becomes a [fetus](#) [9]. The embryos on the database are specimens from the Carnegie Human Embryo Collection that has been kept in the [National Museum of Health and Medicine](#) [7] in Washington, DC since 1990. Eighteen embryos were used to create the images and animations of the ten different stages in the database. Each embryo was visualized through magnetic resonance [microscopy](#) [5], using three different techniques of magnetic resonance [microscopy](#) [5]: T1-weighting, T2-weighting, and diffusion-weighting. Each technique provides different visual emphasis, and together, allows scientists to create highly detailed images of the embryos. Magnetic resonance [microscopy](#) [5] creates detailed images of the embryos through the use of radiofrequency pulses that the cells in the specimens absorb and bounce back, creating the digital images of both internal and external structures.

The online database is organized interactively. In the Images section of the webpage, visitors can open separate pages containing both images and animation of embryos in the Carnegie stages 13 to 23. Selecting a single stage opens up a page containing photographs, animated videos, and MRI sections of the embryo at that stage of development. The color photographs vary in angle and the user can zoom in to see the embryo from multiple viewpoints. The video animations and MRI slices are in black and white. Examples of the animations in the website include animated rotations of the 3D images and time lapse of embryonic development. The MRI slices can be viewed in either the axial, coronal, or sagittal planes. Together, the images and animations provide a view of the embryos from many different perspectives, creating a very thorough construction of embryonic development.

In the Project section of the website, the project summary, project details, and a list of collaborators are provided. The primary aims of the project involved imaging the embryos, producing digital slices and animation, and organizing all images in an organized and publicly-accessible manner. The project was funded from July 1996 to February 2001, and all of the work was completed by June 2001. The process of collecting and imaging the embryo collection is explained in the Technical section of the webpage; the settings and parameters of the [microscope](#) [10] and the type of software used are fully detailed to explain all of the methods used to create the images. A list of relevant websites and references are available in the Links tab. The main contact for the webpage is Bradley Smith. As of 2009, Smith is an Associate Professor in the School of Art and Design and the Department of Radiology at the [University of Michigan](#) [6].

The aim of the Multi-Dimensional Human Embryo is to contribute to the greater accessibility of reference data on human embryos. Though embryological studies on animal specimens are common in embryological research, thorough studies of human embryos have been less common because of the paucity of human embryo records, and the difficulty in obtaining high-quality samples. Consequently, the publication of the Multi-Dimensional Human Embryo contributes a vital source of visual data for embryological studies. The virtual images on the website are intended to be used by individuals from every realm of the public sector, whether for reference in research or personal edification. The accessibility and comprehensiveness of "The Multi-Dimensional Human Embryo" renders it an invaluable tool in human embryological studies.

Sources

1. Brad Smith. "Brad Smith, Biographical Info." Brad Smith. <http://www-personal.umich.edu/~brdsmith/BioGraph.html> [11] (Accessed December 14, 2010).
2. Smith, Bradley R. "The Multi-dimensional Human Embryo." <http://embryo.soad.umich.edu/> [4]. (Accessed October 15, 2010).

3. Smith, Bradley R. "Visualizing Human Embryos," Scientific American 280 (1999): 76–81.

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Links

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