SELECTED SPECIES:
EXPERIMENTS IN ART AND SCIENCE

A Thesis
Presented in Partial Fulfillment of the Requirements
for the Degree Master of Fine Arts in the
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by

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Department of Art

ABSTRACT

A broad history and examination of current trends regarding science, in particular biology, and art. Including examples of the authors work, discussing both content and formal issues. Also examines the representation of science in popular cultural media and the ethical concerns, fears, and common misconceptions, which are manifest in these representations.

Dedication

To all of the atoms and molecules in my body
for making me what I am today.

ACKNOWLEDGMENTS

I would like to acknowledge the many people who have motivated and inspired me through my masters education: Midori Kitagawa DeLeon, Wayne Carlson, and Pheoris West, my thesis committee, for their advice and insight. Fred Marsh for shooting many of the slides shown in the plates. The students, faculty, and staff of the Advanced Computing Center for the Arts and Design, the Department of Art, and the Department of Plant Biology. Special thanks to my parents for their support and encouragement throughout my artistic career, and to Neal for "everything" including not minding DNA hanging over the dining table for an extended period of time.

VITA

[redacted] ..... Born - [redacted]

1990 ..... Bachelor of Fine Arts with concentrations in Electronic Media and Painting, Department of Fine Arts, Carnegie Mellon University, Pittsburgh, Pennsylvania.

1994 ..... Master of Science, Department of Plant Biology, The Ohio State University, Columbus, Ohio.

FIELDS OF STUDY

Major Field: Computer Graphics and Animation.
Other Fields: Installation Art, Drawing, and Painting.

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CHAPTER 1

INTRODUCTION

Science and art are commonly thought to be two disparate fields, lacking in common concerns, methods, and ideologies. They have been called to two cultures, science the analytical separate from emotive art. This apparent chasm neglects the encompassing larger culture and its influence on these culturally based endeavors. It also ignores common goals of the two fields such as the effort to provide insight into the workings of the world.

Historically this separation was not so distinct and legendary practitioners such as Leonardo DiVinci freely worked within both realms. The separation would seem to be lessening in recent years with the onslaught of art based partially or solely on scientific concerns. Another example of this merging is the growing number of individuals working in both fields, as witnessed by recent publications including the *Art Journal* and *Leonardo*.

This text concerns itself with the application of scientific concerns and methodology to the practice of art making. Historical and modern links between science and art are explored, along with the author's own research into combining the fields. The general populations relationship to science, in the form of pop culture representations, is also addressed by the text. The explosion onto the movie screen of science gone awry is one example of popular culture's take on science. These topics are

included in order to illustrate the current climate in which the artworks discussed herein are viewed.

CHAPTER 2

ADDRESSING SCIENTIFIC CONCERNS IN ART AND AESTHETIC CONCERNS IN SCIENCE.

The historical link between art and science, although presented in mystical/mythic fashion in some texts, is concrete and traceable. This association continues today to a greater or lesser extent in many artists' works. Manifestations include attempts at complete integration, to peripheral interactions such as the use of one field as a tool for the other, as in scientific illustration, where aesthetics may take a back seat to clarity of the presentation of data and concepts.

Science and art interact on multiple levels. Artists use scientific fields as sources for subject matter, adopt a scientific methodology, or use scientific technology, in producing their works. Others use materials associated with science as the media by which they create, still others utilize a scientific aesthetic. Some artists have even gone so far as to create artworks which cross the boundary and exist independently both as artworks, and as scientific endeavors. Science, on the other hand, harness' the power of artistic creations for use in illustrating ideas, and promoting concepts. Products of science and its offshoot technology have been used to advance many artistic fields, such as painting, and in the creation of entirely new media.

Science in general provides for many aesthetic breakthroughs. New tools, new abstractions from expanded visions of the world, the visualization of phenomena that take place below or outside the normal range of human perception, all allow for new artistic sources and

subjects. The sciences used as subject include taxonomy, ecology, and physics. Biology and the related fields of genetics, artificial life, and biotechnology are also becoming popular sources.

Artist such as Ann Hamilton[1] and Mark Dion[2] use the organizational and cataloging principles of taxonomy, along with the accoutrements of science in general, in many of their works. The display cases, the ordered rows, the meticulousness, all of these traits are present. Taxonomy as subject is quite prevalent, as well, in the work of Alexis Rockman. Many of his paintings feature the scientific construct of an arbor vitae, depicting organisms relatedness spatially in a branching tree. The artificiality of this model is underscored in his works by the juxtaposition of tree dwelling organisms with ground dwelling organisms, which look quite out of place "tree-ed."[3]

Environmental art and earthworks run the gamut in terms of their involvement with science. The manipulation of a natural setting demands a reading of concern with the ecology, by embodying the relationship of humans to 'nature'. While artists such as Robert Smithson[4] were more concerned with working on a grand scale, than with any ecological viewpoint, others, such as Nancy Holt,[5] produce works which seek to inform about and meditate upon the workings of the universe. Environmental artists have been active in land reclamation projects, which rely on ecological science, similarly artists dealing with sustainable agriculture or aquaculture, such as the Harrisons with the "*Lagoon Cycle*," rely on scientific knowledge and method.[6]

Physics and mathematics find representation in many popular works, while not recognized for the most part in terms of "high" art, this art none the less has quite a following. Escher of course springs to mind, as well as fractal art, and the work of self proclaimed "algorists" such as

Ken Musgrave, who utilize mathematical formulas to produce images approaching the complexity of natural forms.[7]

Biology is well represented in art. Concerns about biodiversity, fascination with biological processes, the human status as animal, and our relationships to other living beings all provide content and hold interest for artists. Several artists even use living organisms as their media, creating new varieties as their art form. Edward Steichen's display of his Delphiniums in the MoMA in 1936 exemplifies this line of inquiry.[8] Artists have rigged up installations for growing plants, created microenvironments for flora and fauna in galleries, even provided for the foraging of bees by drilling holes through the walls of galleries to the outside. Non-human organisms have served as collaborators in several art projects. Ann Hamilton utilized Dermisted beetles, which consumed a turkey carcass in a glass vitrine in "*parallel lines*" (1991), a work which focused attention on the process of collecting for museum display. Hamilton utilizes and displays biological processes which, while focusing audience attention on the process, usually are presented as allegories for things transcending the physical.[9]

In terms of contributions to art, physics and mathematics have historically received recognition, as well they should. Classical sculpture, based on idealized proportions, exemplifies geometry's influence on art throughout the centuries. The development of perspective, discoveries in optics and the nature of color and light, rules of proportion, all allowed for the advancement of painting and what it could depict.[10] Developments in optics have also led to entirely new media such as photography, film, and holography, aided by advances in chemistry. Digital media owes its entire existence to computer science which immerged from mathematics and physics. Little mention is normally made, along these lines, of the necessity of chemistry knowledge in the fields of photography and printmaking. Chemistry also

contributed important developments in the production of stable pigments and new colors in oil paint, and of course the development of plastic polymers that enabled the creation of acrylic paints.

Science of course has always utilized art as a tool. Illustration has been used historically to provide a more approachable presentation of scientific subject matter, to provide support material for data, and to produce a more persuasive argument by engaging the senses along with the intellect. With the advent of scientific visualization ultra-realistic depictions of events or phenomena, along with the visual representation of non-visual, or sub-visual phenomena, can be portrayed. The problem of presenting a paradigm in such a concrete and persuasive way is an issue of some significance. Computer based learning tools are now surpassing traditional illustrated texts in their ability to instruct and promote ideas, chiefly through interactivity.

Process and methodology are another area in which overlaps occur. The language of science has transferred into art, although with altered definitions. Systematic or systems based painting and performance, also known as minimalism and geometric abstraction, utilizes analytical and precise methods in the production of art.[11] While systematists in biology attempt to organize the various forms of life into meaningful groupings. The act of both art and science production utilizes analytical and observational skills. Creativity which is normally thought to be the domain of the arts, is a skill utilized in the sciences both in terms of framing the questions, and in the search for answers. The creativity of science is sometimes discussed in terms of "intuition", but this phenomena may be due more to experience and familiarity with the subject of concern combined with a new mode of thinking triggered by some random experience.

A primary example of aesthetics coming into play in science would be in the field of genetics. The production of ornamental lines of many species of plants and animals takes place across many cultures. The tradition of breeding animals for aesthetic purposes provided the impetus for Darwin's contribution to evolutionary theory. Genetic manipulations have been made to *Arabidopsis*, the favored experimental plant in the mustard family, affecting the morphology of the flower. The visually stunning results of this experiment also serve to provide a greater understanding of genetics, and the evolution of flowers.[12]

Leonard Shlain attempts in his book *Art & Physics - Parallel Visions in Space, Time, and Light*, to define the relationship of this particular science to art. While he does present a good overview of the historical links, and provides a quite readable explanation of advanced physics theories, some hypothetical connections he presents exist merely in afterthought or as projections. He posits artistic foresight of specific discoveries, predating their discovery by scientists. He likens artists to prophets whose individual knowledge spans the entire spacetime continuum. An example projection is found in his writing about *The Dance* by Matisse:

> A few years after Matisse's painting, nuclear physicists discovered that life itself is based on the carbon atom, which has in its outermost orbital four negatively charged electrons whirling about the stationary, positively charged nucleus. These four dancing electrons are always looking for four more to join them. When their entreaties are answered, they begin to build the interlocking chain-link pattern of life. In Matisse's version, there are five dancers, but there is a break in the hands of two of them as if inviting a sixth or more to participate. The immense deep blue background is quite startlingly prescient because physicists have discovered since the painting was made that the representative color of nuclear energy is blue. *Art & Physics* pp.184 - 185.

An example which negates this mystical line of thought would be that of Hooke and Seurat. "Monet is only an eye, but -- oh, what an eye!"[13]

could also be said of Robert Hooke who's simple observations of materials and organisms under the microscope inspired and was the genesis of advances in numerous fields of study. The relevant observation, published in 1665, being that even in the most well mixed pigments, individual particles of pigment retain their properties, and what the eye perceives as purple on the canvas, is in reality blue and red pigments seen in close proximity. In his own words, "Thus have I by gently mixing *Vermilion* and *Bife* dry, produc'd a very fine Purple, or mixt colour, but looking on it with the *Microfcope*, I could eafily diftinguifh both the Red and the Blue particles, which did not at all produce the *Phantafm* of Purple."[14] Georges Seurat's pointillism works date in the late 1800's.

A more acceptable theory has been posited, rather than some mystical link between artists and the unknown, as to the correlations between the arts and sciences in a given era. Mainly that both of these endeavors reflect underlaying thoughts of the culture, a specific mind set, due to advances in education and increased leisure time, which gives rise to a similar interpretation of what subjects are important enough to depict in art and what questions should be asked of these subjects for the advancement of knowledge and science. This theme or undercurrent known as the zietgeist.[15]

Regardless of their conception, the cultural endeavors known as science and art are again in a state of overlap. With the enormous strides science is making in understanding countless areas of interest, there can only be more and more results which are in some way threatening to many people. Society will have to come to terms in some way with these advancements and the changes they bring. The interests and concerns of artists will most certainly continue to focus on science.

CHAPTER 3

PERSONAL EXAMPLES OF WORKS LINKING ART AND SCIENCE.

3.1 STRUCTURE

The multiple artworks which comprise "Structure" had their genesis in an a large oil painting (Plate I). From there expanding into a digital still, a computer animation (Plate II), and various supporting materials. The purpose of the painting was to depict underlying structure and the impact of this structure on the form of organisms, both in the animal and the plant kingdoms. The impetus behind this work being that the public has some understanding of the skeletal system and its impact on their particular form, and the general form of the other animals. Most people have no such understanding of plant cell structure and how that structure influences the form of the plant body.

This simplistic concept expanded into an exploration not only of macro and microscopic structure, but also delved into the structure of the smallest part of any organism, elementary particles. The transition from a painting into 2D and 3D computer animation allows for information to be related in an expanded manner. Simultaneous presentation gives way to sequential images. A frozen moment translated into a linear narrative. The ultimate issue being addressed visually in the work is our understanding of the universe, and how the basic structure of matter affects all levels of reality. This issue is presented in the form of animal life and plant life, separated compositionally into halves of the screen. Differences and similarities in these representative kingdoms are addressed in terms of basic science, such as cell structure.

With the addition of digital and time-based media, the structure of the chosen media became an additional concern, how the image is produced, presented and perceived. These structures include the existence of digital images as data, the fact that they result from an entire image being perceived from a group of discrete pixels, and the structure of film or video as series of discrete or semi-discrete images which are perceived as a continuous real time event. Formal compositional issues are also addressed, along with the structure of the digital and video media itself. The resultant animation presents an overview of structure, both of reality, and of our forming of reality into meaning by examination.

Background concerns which are present in my other work are also present in the "Structure" series. These concerns include death as a result of scientific methods of inquiry, which seems to be an underlying need to destroy a system or organism to understand it. Another issue is the difference between pets and specimens. The concept of "pet" and "specimen" both require an objectification of the animal, one with a projection of emotions, the other producing an object of inquiry out of a living being. The pet goldfish who was the subject of the original painting died and is now preserved in ethanol, along with the plant subject, and they have been exhibited with the other elements of "Structure".

Water has also become a key element of the work, both organisms depicted are aquatic, and they share the trait of having most of their volumes occupied by water. The liquid reference also refers to the paint as a liquid media, which is apparent in the use of visible glaze drips in the oil painting. The handling of the paint works to switch the space of the painting in and out of viewing as a realistic depiction and viewing as the corresponding physicality of paint on a surface. Wave like algorithms used in the image processing portion of the animation serve as the water reference in the digital work. These wave algorithms also

relate to the particle wave duality of elementary particles. Wave functions are also utilized in the timing of the animation.

The method by which the animation was created was reminiscent of painting, in that it was produced in a linear fashion. Sequences of images were produced from a starting point and with a motive, but without the locked down methodology common to more commercial computer graphics. The 2D portions of the work, and some transitions in the 3D portions were produced by image processing. This image processing employed Xpost, an image processing program written by Pete Carswell, controlled by shell scripts generated by Perl programs written by the author. In this manner specific functions, such as distorting the image based on a sine curve, were incremented and animated. The 3D portions of the animation were produced using the commercial software Alias Power Animator.

Another goal in the production of the "Structure" series was to create artworks with artistic merit which also function as a means of presenting sound scientific information. This goal led to questions of our assumptions about reality and the necessity of models to represent processes which are indescribable outside of physics and mathematics. Problems with trying to visually depict the invisible include oversimplification and the ability for the visuals to remain in peoples thoughts long after the data they are based on has been reassessed. In the early stage of the animation there was no distinction in terms of what is real and what is a model. Continuing in a linear fashion and in the same color gives coherence to the event happening, going from macro to microscopic. It presents the subject as the same matter, the constituents of the original bone, but this is a fallacy in that invisible particles have no color, that they are not viewable in the standard sense. The structure of models is an offshoot of the structure of thought. The electron orbit exists as data just as the image exists as data.

Additional problems and questions arose during the production of the animation. Does one use representations which are common, Bohr models from basic textbooks for example, so that the majority of viewers will understand what is supposed to be represented? Or does one try to show the most advanced model, in keeping with up to date theory? Again, the problem with placing models continuous with real materials, and also with representing invisible materials and phenomena with visuals. There are historical instances when invisible ideas were represented in art, through realism that functioned as allegory, the non-visual ideas being a thought, emotion, or sin.

3.2 THROUGH THE LOOKING GLASS
(Symbolism for Microbiologists)

"Through the looking glass" (Plate III) began as an exploration of cloning and genetics, based on a purely informational level. It was to be a opportunity for me to reestablish my own knowledge of genetics through explaining a cloning technique, and depicting this information visually. This work was to and does rely on traditional illustrative depiction of the subject matter. Originally the work was going to explore and explain the specific scientific protocol text. This explanation was to be made through the physical and representative depictions of the actual process, coupled with illustrations of scientific models of what is believed to be happening on the microcellular level. Visually the text was to be clarified and focused by the overlay of a petri dish containing colonies of altered bacteria. In the original work all imagery was to be depicted on the single plane of the drawing.

New advances in biotechnology, specifically cloning, made me reassess the work and its potential meaning. The two dimensional plane expanded into three dimensions as the content of the work developed. Additional objects which create the space of the work serve both a formal physical and metaphorical purpose. The mirror through which the viewer examines the drawing represents what explorations of genetics offer us, a mirror of ourselves. Cloning provides us a new way of examination, a new way to view our world in terms of scientific knowledge, but also our conceptions of ourselves. The mirror also functions to place the viewer inside the debate and provides a body double and partner with which to explore.

The standard image of sheep jumping over fences, counting sheep to go to sleep, suddenly has new meaning with the production of Dolly. Identical sheep leaping easily over a barrier, the biological barrier of cloning large mammals has been broken. This was physically manifested in the show as commercially available, realistic, identical plastic toy sheep. The wooden fence over which they leap is a partially loosened DNA spiral.

Fingerprints remain on the surface of the drawing, a deliberate reminder of the individuality of the artist. Identification by fingerprint depends directly upon unique patterns, bringing up the question of defining individuality and uniqueness. This has particular relevance in the American culture, as it is based upon the individual and the individuals rights. The concept of uniqueness is also an issue within the arts. The importance of the original has pervaded art making, with the primacy of painting, and is something that print and digital media have had to struggle against.

3.3 MOUSEGRID

"In particular, our sentimentality towards animals is a sure sign of the disdain in which we hold them."
- Jean Baudrillard from *Simularcra and Simulation*

The interactive web based work "MouseGrid" (Plate IV) is displayed in an installation setting which includes video projection, sound, smell - in the form of pine shavings, and containers - mouse tanks sans mice. These surrounding materials serve as support for the interactive work, providing an environment in which to experience the piece. They also work to suggest presence and absence, the subjects of study being present in the cataloging video and as the manipulated subject in the interactive, yet physically absent from the actual environment - their tank enclosures. The mice do not speak or exist for themselves, they are only present through interpretation and representation.

Issues of subjectivity and objectivity are addressed in the interactive work. These issues are addressed through the use of mice, presented in varied degrees and kinds of objectification, from their use as a model organism for scientific experiments through their anthropomorphic representation in popular culture as cartoon characters. These are the two extreme poles of the relationship of humans to animals. On the one hand the lack of empathy needed in order to do animal experimentation vs. the projection of human characteristics onto animals due to over empathizing.

The format of the work is to present various bit of "data" concerning this subject in a semi-structured, non-linear fashion. The images and texts are presented, juxtaposed in a neutral setting, and the viewer is left with the task of constructing their own meaning. The lack of an obvious viewpoint or opinion for the work, the veiling of the artists "intentions," has been disturbing for some viewers. When presented with an objective artwork, they are upset that it seems to make no clear statement. They are used to artwork produced in a subjective manner rather than from a more objective stance, usually associated with science.

The presentation of the existence of objectivity is in itself a falsehood. It assumes the complete separation of any cultural or personal belief from the production or action. A point of view is inevitable, as nothing happens in a vacuum. Cultural biases do exist and inform any cultural production, including art and science. Biases are easily recognizable with hindsight, as witnessed by histories on the philosophy of science. A caveat being that the very act of writing a history imposes a linear narrative on events that were likely to be less well defined.

Formal material issues of the media are addressed in "MouseGrid" by the use of standard HTML conventions - visible tables, in this case transformed in the main page to be representative of a mesh windowed enclosure for mice. Another formal issue is the production of an installation around the web based work instead of simply placing a computer naked into the gallery space. This allows the computer machinery to become a part of the piece instead of it being just a means to an end. Allowing the viewer to become immersed and involved, instead of continually realizing that they are simply viewing a work on a computer.

3.4 BUILD YOUR OWN CRITTER

"Build your own critter" (Plate V), an interactive web based work, had its inception in my desire to use frames. Frames was, at that time, a new functionality of the web browser Netscape which allows the site designer to control how a user can view a site. The sites available with this function, at that time, seemed to utilize the frame areas simply for control and display, such as an index side which would control the text viewed in a different frame of the window. The example sites were all business related, so I decided to appropriate this functionality for artistic ends. This also introduced my use of HTML to address formal concerns, mainly that the devices used be a integral part of the work.

Another inspiration for this work was sectioned children's books, those in which each page is split into thirds, and the child can create combinations of images from the original selections. The frames function allows for the coherent display of non-standard sized pages, in this case, three long images, each containing the relevant portion of various animals. The user can use scroll bars to line up, for example, a human head, a mouse midsection, and a duck lower body and legs, thereby creating a new trans-species critter.

"Build your own critter" utilizes a game or play format, which supports the content of the piece on multiple levels. The general populous' fear of biotechnology stems from, in addition to general ignorance, a misunderstanding of the process of science. The image of the scientist, is, usually, male, along with being a forgetful, socially inept, misguided megalomaniac, lording over his laboratory. This man's only limitation being his ability to overcome the logistical barriers to obtaining his goal.

This imaginary scientist has, of course, little or no concern for problems that may stem from success, gives no thought to ethics, safeguards, etc... While this image may make for good horror movie, it hampers the public's ability to deal with scientists and science. This image neglects the checks and balances offered by the scientific methodology such as: peer review, the necessity of exposure when presenting experiments to a funding agency, and the very difficulty of the work itself.

The play aspect of the work allows the user to act out the role of this fearful scientist, controlling the very stuff of life, mimicking the creation of their vision in living tissue. The play aspect simultaneously circumvents this fear and allows the user to ruminate on the truly amazing joy of creation, that biology is no longer destiny, and the miraculous achievement of mankind with this huge breakthrough in understanding and ability. Within this ambiguous space viewers have the opportunity to reexamine the subject and reassess their thoughts.

The simplistic style of the work is emblematic of the concern that it is all to easy to produce clones or transgenic organisms. This overlooks the fact that there were, in Dolly's case, hundreds of attempts which resulted in one cloned sheep. Humans have been working towards this moment continuously from the time plants and animals were first domesticated. First by the brute force approach, controlling genetics with the sledge-hammer of selective breeding, then the tweezers of gene guns, and gene insertion, and now looking toward future tools with abilities that much more refined. The reference to child's play also refers to our present level of ability, as the future will most certainly prove that the work done now will seem painfully simplistic. The rough hewn nature of the creatures produced has ties to both Frankenstein's haphazard construction and less ominously to the Chimeras of Greek and Roman mythology. These aforementioned hybrid creatures of human intellectual creation may well provide a model for dealing with our physical creations.

3.5 UNTITLED (WORM / CYCLES)

Upon the moving of the Herbarium from the Botany and Zoology building to the Museum of Biological Diversity at the Ohio State University, I became the owner of a collection of discarded specimens. This collection of bottles helped me develop focus on the purpose of collecting, the importance of the goals of the collector, and the idea of a specimen. A specimen is something separated from its environment and time, plucked out of its natural cycle. Something frozen and preserved, in an imperfect state. All preservation is destructive in some way, either because it prevents the organism from fulfilling its natural role: reproduction and decay, or because it necessitates the destruction of a living vibrant system, in order that it can be examined. Preservation also causes the system, cells, etc.. to change, causing artifacts, removes color, changes the system being studied. The jars and specimens themselves are beautiful objects, attempts were made to use them as materials, but I found that they are perfect in themselves. The ghost like bleached remains, collected in the early part of this century by scientists whose own bodies may very well have disintegrated by now. The specimens are dead but suspended in time, to be utilized in the future.

The inability to alter or co-opt these objects led me to attempt to take them into a separate context. I decided to explore the object formally by modeling in the computer environment and see what developed. Concurrently, I was working with creating organic forms digitally. These plant like objects referenced primitive land plants, in particular *Cooksonia*. This exploration also led to the development of a form lying in between the plant and animal realm. The concept of dividing nature into human defined categories is quite interesting, especially in those

areas where particular organisms refuse to be so organized. Examples being the platypus which morphologically seems to exist between the mammal and bird divisions, and *Euglena* which floats between the animal and plant kingdoms by its possession of motility and eyespot and by its ability to photosynthesize. Primitive unicellular organisms like *Euglena* seem to be less sharply defined, enabling them to bridge the gaps between kingdoms.

Combining this "Primordial Scene" with the 3D modelled jar, an insight into breaking back into the cycle of life, the idea of specimen, and additionally the viewing of Chris Marker's "La Jette" led to the animation and installation "worm/cycle". The animation consists of a series of vignettes from the point of organism in its environment, its submission to the scientific process, through to the subverting of this process and the return to a more natural process. There is no clear resolution, life does not triumph over death, nature does not defeat science, rather there is an overcoming of the suspension, and the attempt at preservation, the stilling of life is defeated. The animation itself was represented in the thesis show as an installation of stills (Plate VI) from each scene, displayed along with a selection of specimen jars (Plate VII).

CHAPTER 4

CONCLUSION

Science is seldom seen from a middle ground, rather the public view vacillates between science the savior and science, or its offspring technology, the destroyer. Fear and/or misunderstanding of science is due in some part to ignorance, some of which is self induced. There is a perception that science is uninteresting, due in some part to the nature of the research and the writing in the area. An even more damaging perception is that science is not understandable to lay-people. This perception results in self and culturally perpetuated science illiteracy in a culture which heavily consumes science.

The subjects that science addresses do hold great interest to the general public, however, and this has lead to the continuation of pseudoscience. Mesmerism has now given way to a "bastardization" of quantum theory. The diluted nature of scientific theories presented, along with a more approachable writing style, partially explains the appeal that pseudoscience has over science, for many people.

A recent study of scientific literacy in America showed an abysmal lack of general scientific knowledge.[16] Given this level of scientific illiteracy, critics and artists alike may be unequipped, or at the most slightly better equipped than the general populous to deal with this subject. One highly respected art journal published a critique which described a grafted cactus not as a metaphor for cross-species organisms, but as a

"mutant hybrid."[17] These may be credible words in terms of describing the work, and if the work had been a painting, unobjectionable. Used to describe a living plant, however, they take on the scientific meaning and are in this case inappropriate. Hybrid indicating the result of a genetic cross of dissimilar parents, mutant indicating a genetic mutation, neither of which is applicable to a grafted plant.

In my own personal experience artists usually discuss science ideas which have already been popularized, just as art theory relies on thought stemming from psychology and philosophy which are not the cutting edge, nor most current in those fields. It is quite difficult however, in our information saturated age, for even the experts in these fields to keep up to date with advances within their subject area which arise outside of their immediate research interests. It would be unfair to suggest that artist or others working outside of these fields should have more than a passing grasp of the particulars. When desiring to produce works combining art and science, seeking out collaboration seems to be the answer which would solve problems of content and interpretation.

Science is narrative. It produces meaning, both in terms of understanding the physical world, and providing transcendent meaning to redefine the place of humans within the universe. Art has traditionally been associated with transcendence in the form of religion, and narrative in the form of illustration. The combination of art and science allows artists to address both age old, and brand new, fears and desires, with new outlooks, techniques, and tools.

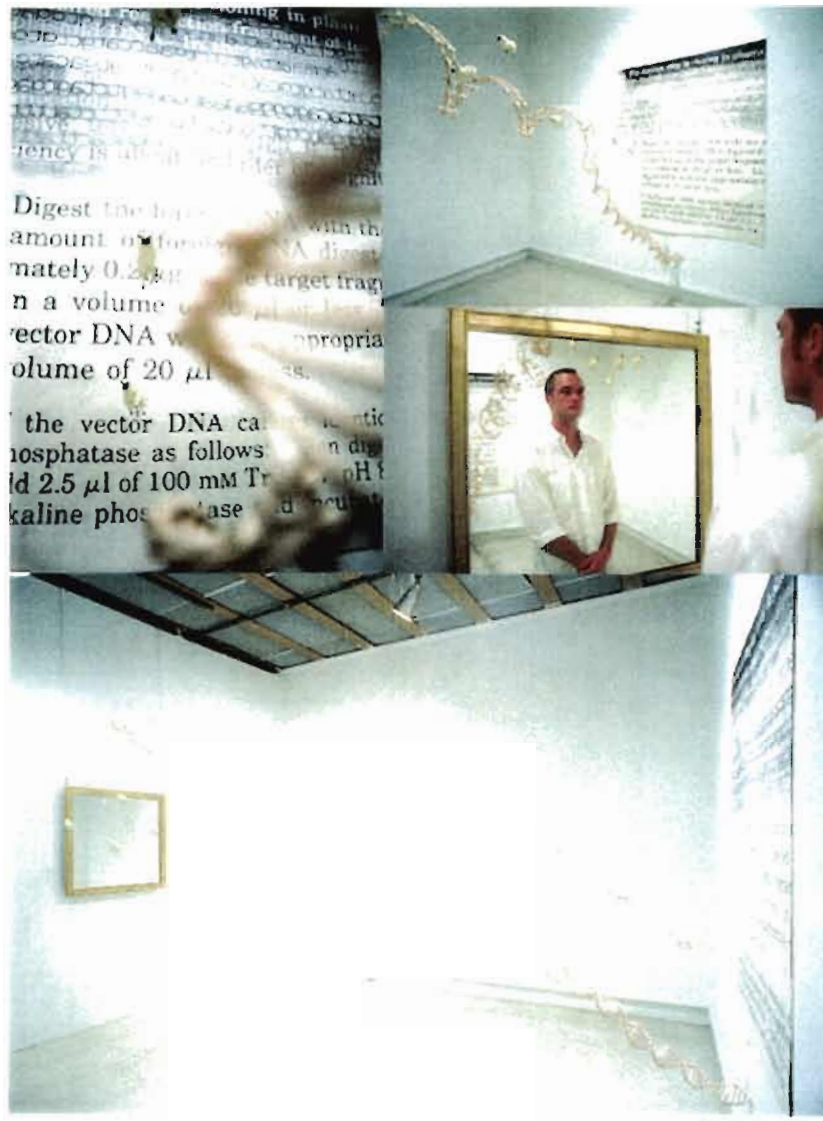
Art and science, these two mode of contemplation, have much to offer each other. Aesthetic breakthroughs have been brought about by science, both by the production of new tools, and by allowing an expansion of the range of human perception and concerns. Allowing for an expanded vision of the universe, exposing hidden realities, science

continually opens our eyes and our minds to the wonders around us. This should and does sound quite similar to one of the definitions of the function of art.

PLATE I

PLATE II

PLATE III


Digest
amount
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n a volume
ector DNA
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d 2.5 µl of 100 mM
kaline

PLATE IV

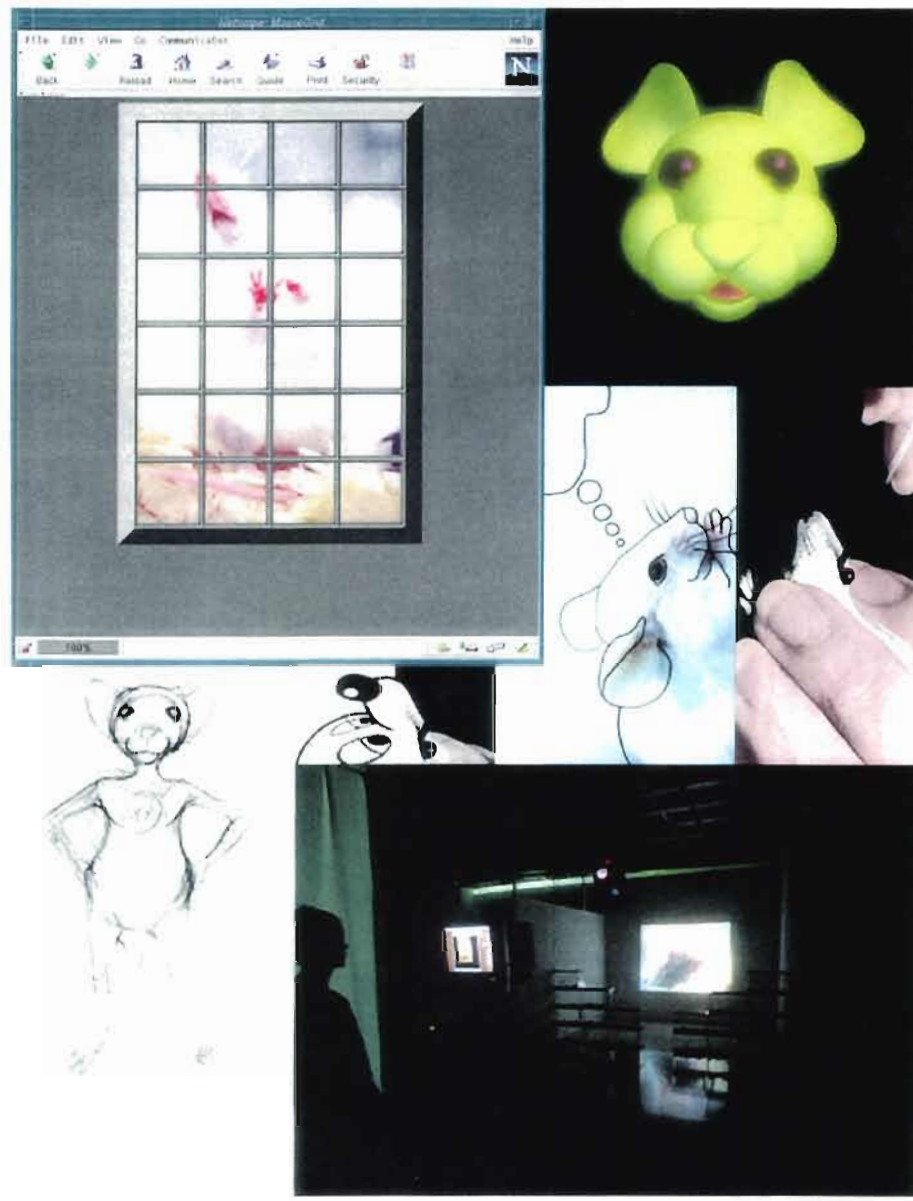

PLATE V

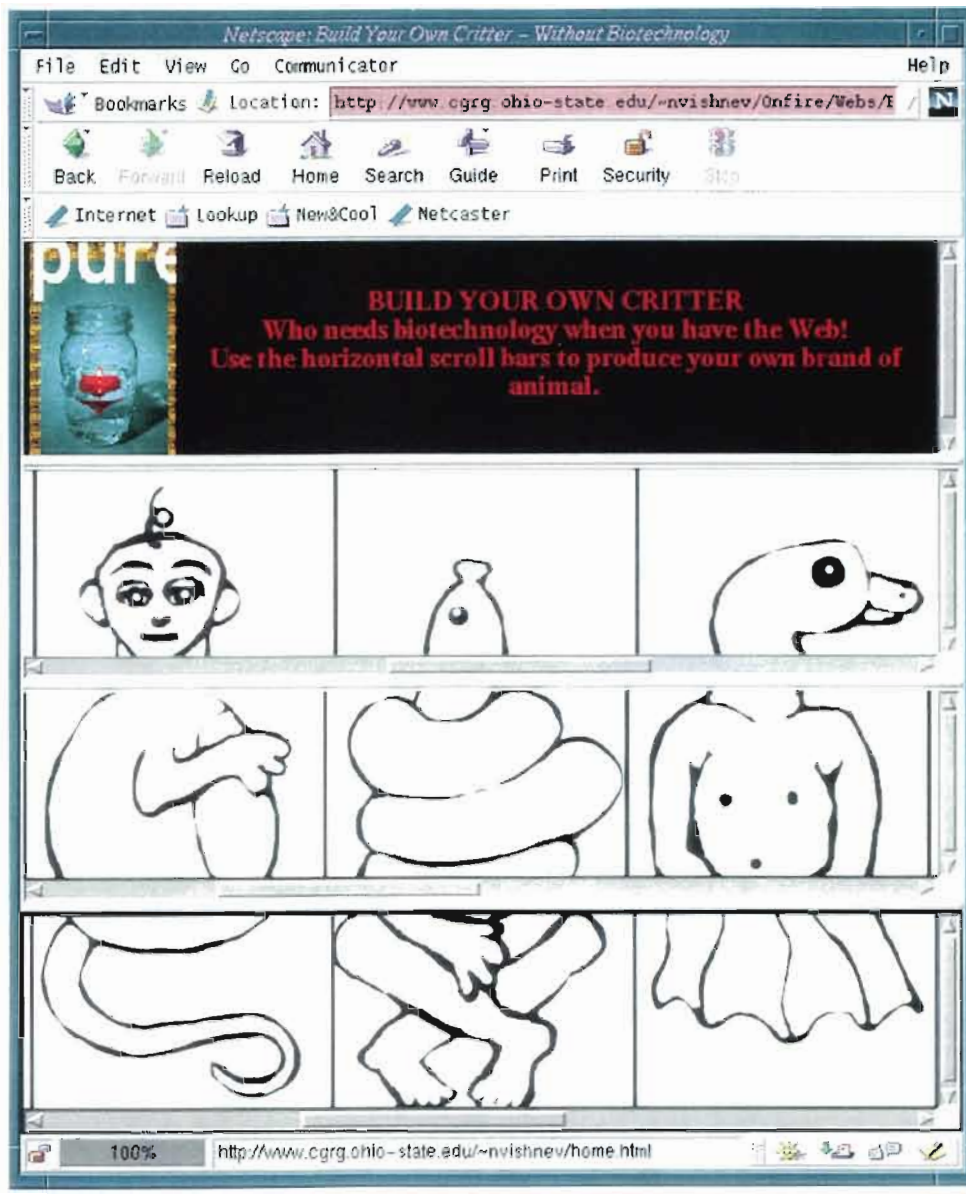
Netscape: Build Your Own Critter - Without Biotechnology
File Edit View Go Communicator Help
Bookmarks Location: http://www.cgrg.ohio-state.edu/~nvishnev/Onfire/Webs/I
Back Forward Reload Home Search Guide Print Security Stop
Internet Lookup New&Cool Netcaster
BUILD YOUR OWN CRITTER
Who needs biotechnology when you have the Web!
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PLATE VI

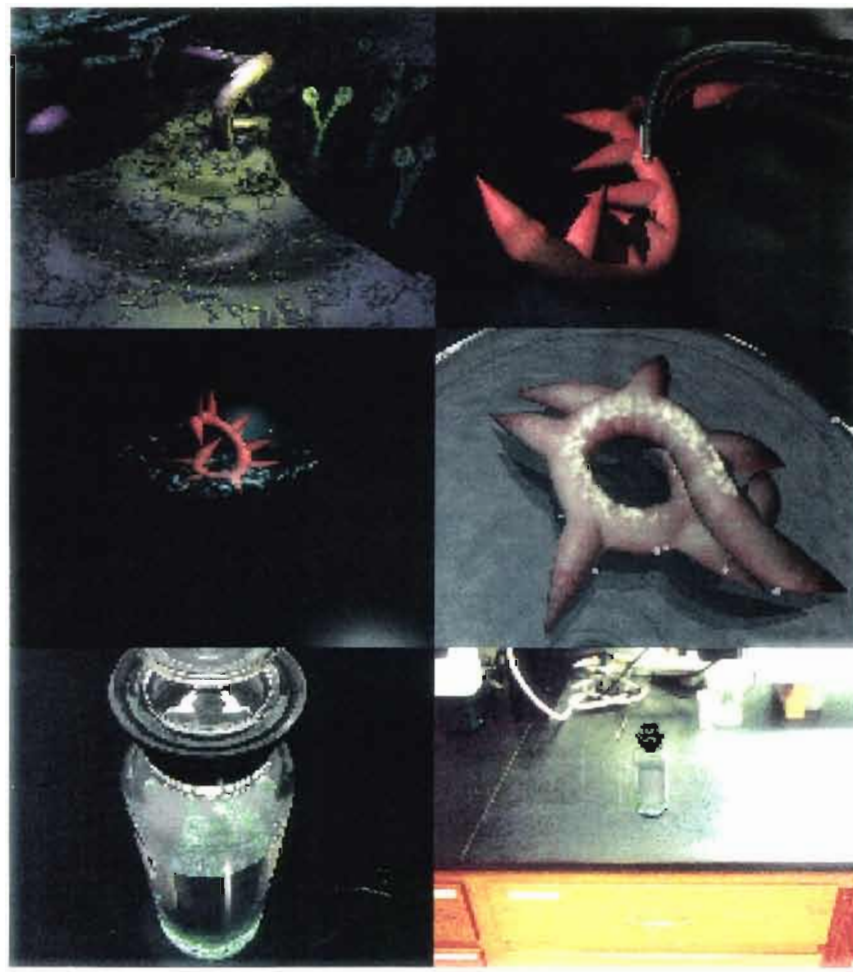

PLATE VII

ENDNOTES

1 & 2. As exemplified by their works displayed at the Wexner Center during 1996 - 1997,

3. Stephen Jay Gould, "Boundaries and Categories", included in *Alexis Rockman: Second Nature*, pp. 26 - 43.

4. Robert Smithson, "The Spiral Jetty", *Theories and Documents of Contemporary Art*, pp. 530 - 536.

5. Nancy Holt, "Sun Tunnels", *Theories and Documents of Contemporary Art: A Sourcebook of Artists' Writings*, pp.536 - 540.

6. Helen Meyer Harrison and Newton Harrison, "Nobody Told Us When to Stop Thinking", *Theories and Documents of Contemporary Art: A Sourcebook of Artists' Writings*, pp.566 - 571.

7. Nancy A. Hitchcock, "Ken Musgrave", *Computer Artist*, February/March 1997, pp. 17-19.

8. Ronald J. Gedrim, "An Art for Life's Sake", *Edward Steichen: Selected Texts and Bibliography*, p. 36.

9. Dave Hickey, "In the Shelter of the Word: Ann Hamilton's *tropos*", *Ann Hamilton, tropos, 1993*, p. 117 - 143.

10. Leonard Shlain, *Art & Physics - Parallel Visions in Space, Time & Light.*

11. Kristine Stiles, "Geometric Abstraction", *Theories and Documents of Contemporary Art: A Sourcebook of Artists' Writings*, p. 70.

12. Carol Fletcher, "A Garden of Mutants", *Discover*, August 1995, pp. 49 - 53.

13. Leonard Shlain quoting Paul Cézanne, *Art & Physics - Parallel Visions in Space, Time & Light*, p. 112.

14. Robert Hooke, *Micrographia*, p. 78.

15. Rom Harré, "What is the 'Zeitgeist'? Prospects and Problems for the Investigation of the Interaction of Arts and Sciences", *Common Denominators in Art and Science*, pp. 1 - 8.
16. All Things Considered, Friday, 5/24/96, on National Public Radio reporting results of a National Science Foundation test for basic science knowledge.
17. Kerby Gook, "Laura Stein", *Art Forum*, v.33, October 1994, p.105.

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