Jacob Bronowski,

The Compassionate Scientist

Peter Sarfaty, BA (Sydney), BA (Hons) (Murdoch),
Dip Clin Psych (UWA)

This thesis is presented for the degree of Doctor of Philosophy, Murdoch University

2006
Declaration

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary educational institution.

__________________________________________
Peter Sarfaty
Dedication

To Elizabeth Joan Sarfaty
Abstract

This thesis attempts to analyse the life of Bronowski through his work and his discussions of his personal values, so the reader will gain an understanding of the “creative imagination” in science and art, as basic to human specificity.

Jacob Bronowski was born in Lodz, Poland, in 1908, the eldest of three sons of Abram Bronowski and Celia Flatto. During WWI, Russia invaded Poland, the family moved to Germany, and in 1920, Abram who had a linen export business with England moved the family to England. Jacob, who spoke no English, went to the Central Foundation School in London, and on to Cambridge University, where he was a student of Jesus College, graduating with a PhD in Mathematics in 1933.

Being in England gave Bronowski a “light” experience after the “dark” of Poland. England’s “civilized minds” excited him and he was fascinated with the English language, which he described as “boney”, meaning the language, and the words, could be understood by topological (geometrical) structure. While at Cambridge, in companionship with another mathematician, William Empson, they edited a literary journal *Experiment*. This gives a lead to the “creative mind” which characterises the human species, a feature which Bronowski develops during the course of this thesis.

During a daylight air raid on London in 1941, Bronowski married Rita Colin (Coblitz) sculptor, and they subsequently had four daughters, Lisa, Judith, Beth and Clare.

In English schools, it was usual practice for boys to refer to each other by their surnames, and Bronowski, as a school boy and throughout the remainder of his life was known as Bruno, the Polish diminutive of Bronowski.

When he was at Cambridge, Rita realised, that as a Jew, her husband was not going to be accepted as a Fellow of Jesus College, so he left Cambridge and over the years 1945-1964, when he worked for the Government in England, he developed a reputation as a lecturer, broadcaster, public educator, literary critic, mathematician and extensive writer.

In the thesis, Bronowski’s works are analysed including: *Science and Human Values*, *The Poet’s Defence*, *William Blake and the Age of Revolution*, *The Origins of Knowledge and Imagination*, and the BBC TV production, *The Ascent of Man*, a
Knowledge and Imagination, and the BBC TV production, The Ascent of Man, a thirteen part series about the development of animal and human life, from the grunion, a fish on the beaches of La Jolla, San Diego up through modern day studies in quantum physics and DNA structures.

There is a seventh chapter which analyses, The Visionary Eye, a series of essays and lectures put together by his wife Rita in 1978 to show “the bright ribbon of imagination” in her late husband.

I created the thesis title Jacob Bronowski, the Compassionate Scientist to reflect how his values, and activities and ethics reach out to me and touch me. Bronowski’s belief that “being a Jew meant to me having a profound sense of intellectual values. It meant being tolerant of the thoughts of other minds, not out of indifference, but of respect, above all out of self respect ..... ethical values of Judaism state we are all responsible for each other.” (Bronowski, 1968: On Being a Jew).

These values led Bronowski out of the shock of seeing the destruction of Nagasaki from the atomic bomb, through his thoughts on the Spanish civil war, and the propaganda of Nazism, out of the “ashes” of Auschwitz (part 11 of The Ascent of Man) to become involved in human biology, meeting with Jonas Salk and joining the Salk Institute in 1964.

Writing the thesis has given meaning to my life, about optimism, courage and ethical values, and I do trust it will convey those values to the readers.
# Table of Contents

<table>
<thead>
<tr>
<th>Abstract</th>
<th>i</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table of Contents</td>
<td>iii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>vii</td>
</tr>
<tr>
<td>List of Figures</td>
<td>viii</td>
</tr>
<tr>
<td>List of Tables</td>
<td>xiii</td>
</tr>
<tr>
<td>Prologue.</td>
<td>1</td>
</tr>
</tbody>
</table>

## CHAPTER 1

A Panorama of Bruno's Lifelong Intellectual Struggle.  

1.1 Bronowski the Broadcaster.  
1.2 The Nature of Bronowski.  
1.3 Bronowski and his family of origin.  
1.4 Bronowski at Cambridge.  
1.5 Bronowski in England.  
1.6 Bronowski’s move to the Salk Institute.  
1.7 Bronowski accepts the BBC’s invitation.  

## CHAPTER 2

As Reasoned as Geometry.  

2.1 As Reasoned as Geometry  
2.2 Sir Philip Sidney  
2.3 John Dryden  
2.4 William Wordsworth  
2.5 Samuel Taylor Coleridge  
2.6 Percy Bysshe Shelley  
2.7 Algernon Charles Swinburne  
2.8 Alfred Edward Houseman  
2.9 William Butler Yeats
### CHAPTER 3

From Peterloo to Belsen.  

- 3.1 Bronowski’s passion for William Blake.  
- 3.2 A selection of poetical and prophetic works of William Blake.  
- 3.3 Blake’s Writings and Concept of the World Structure  
- 3.4 Blake’s Vivid Symbols.  
- 3.5 Blake’s “Time Hatreds.”  
- 3.6 Blake’s Dialectic.  
- 3.7 The Auguries of Innocence.  

### CHAPTER 4

Bronowski develops his Epistemology.  

- 4.1 Optimism in Bronowski’s belief that humans desire the good society.  
- 4.2 Science and human values.  
- 4.3 Bronowski joins the Salk Institute.  
- 4.4 George Derfer interviews Bronowski  
- 4.5 The Identity of Man (1965).  
  - 4.5.1 A Machine or Self.  
  - 4.5.2 The Machinery of Nature.  
  - 4.5.3 Knowledge of the Self.  
  - 4.5.4 The Mind in Action.
CHAPTER 5
Bronowski Develops and Deepens His Epistemology and Associates it with Social Behaviour. 199
5.1 The Face of Violence. Six introductory essays. 300
5.2 The Face of Violence. BBC play. 215
5.3 The Origins of Knowledge and Imagination. 224
  5.3.1 The Mind as an Instrument of Understanding. 228
  5.3.2 The Evolution and Power of Symbolic Language. 235
  5.3.3 Knowledge as Algorithm and Metaphor. 244
  5.3.4 The Laws of Nature and the Nature of Laws. 257
  5.3.5 Error, Progress and the Concept of Time 266
  5.3.6 Law and Individual Responsibility. 276

CHAPTER 6
Bronowski’s Compassion for Humans Reaches its Ascendancy. 288
6.1 Lower than the Angels. (Anatomy and Intellect) 288
6.2 The Harvest of the Seasons. (Agriculture) 291
6.3 The Grain in the Stone. (Architecture) 291
6.4 The Hidden Structure. (Chemistry) 293
6.5 The Music of the Spheres. (Mathematics) 295
6.6 The Starry Messenger. (Astronomy). 298
6.7 The Majestic Clockwork. (Physics) 302
6.8 The Drive for Power. (Industrial Revolution). 307
6.9 The Ladder of Creation. (Theory of Evolution) 310
6.10 World within World. (Atomic Energy) 313
6.11 Knowledge or Certainty. (Science and Humanism) 323
6.12 Generation upon Generation. (Genetics) 328
6.13 The Long Childhood. (The Future) 333
CHAPTER 7

Living is a Play of Values.

7.1 Introduction. 341
7.2 The Content of The Visionary Eye. 344
7.3 The Nature of Art. 344
7.4 The Imaginative Mind in Art. 347
7.5 The Imaginative Mind in Science. 353
7.6 The Shape of Things. 358
7.7 Architecture as a Science and Architecture as an Art. 364
7.8 Art as a Mode of Knowledge. 371
   7.8.1 The Power of Artifacts. 372
   7.8.2 The Speaking Eye. The Visionary Ear. 376
   7.8.3 Music, Metaphors and Meaning. 382
   7.8.4 The Act of Recognition. 387
   7.8.5 Imagination as Plan and as Experiment. 392
   7.8.6 The Play of Values in the Work of Art. 399
7.9 Summary 408

Epilogue. 409

BIBLIOGRAPHY 415
Acknowledgements

I wish to thank my thesis supervisor, Professor Philip Jennings, Professor of Physics and Energy Studies for his personal interest, over many years, in the work I have done to produce this thesis. The thesis title which I used to begin with was The Passions, Beliefs and Values of Jacob Bronowski and when I felt the passion and changed the title to Jacob Bronowski, the Compassionate Scientist I felt that I have not only acknowledged Jacob Bronowski but my regard and respect for Professor Jennings also.

My late wife Elizabeth Joan Sarfaty, whom I mention in the Epilogue, not only consistently encouraged me, but also learned to use the word processor loaned by Murdoch University to type up the first five chapters, before her fatal illness overtook her in 2002. My dear wife is still with me, especially when I think of Jacob Bronowski (in chapter 6 of the thesis visiting Auschwitz) and crying out “we must reach out and touch people.”

This leads me to say that whenever I have wanted administrative reassurance about re-enrolment each year I value the responsiveness of Karen Olkowski and Anne Randell.

The thesis would not have moved much beyond chapter 5, had the Department Secretary June Burnett not taken up typing, checking, drafting chapters 6, 7 and 8. And I must mention the secretary of the Department in earlier days, Lyn Simpson.

The Murdoch University Library staff have never failed me in their responsiveness to my requests for books and articles. The names of Ari, Doris MacIntyre and Kay Weaver of the Extension Service come to me, Sue Dowling, Electronic Services Librarian and Jenny Smith, Science Department Librarian have been supportive. No doubt there are other members of the Library staff, whose names I do not know who have secured books from other Universities and interstate for me.

Murdoch University is a fine institution, going back to my early BA studies and I have photographs of shaking hands with Sir Ronald Wilson, Chancellor when I graduated in 1994, BA Hons as well as a photograph of my wife Elizabeth and I in the Perth Concert Hall on that occasion.
<table>
<thead>
<tr>
<th>Figure Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Jacob Bronowski in a Characteristically Thoughtful Pose.</td>
<td>6</td>
</tr>
<tr>
<td>1.2</td>
<td>Here Pythagoras Whimsically and Carefully Balances His Square on the Hippopotamus.</td>
<td>7</td>
</tr>
<tr>
<td>1.3</td>
<td>Here are four pages from Hall and Stevens A School Geometry.</td>
<td>9</td>
</tr>
<tr>
<td>1.4</td>
<td>Cover of John Bonnycastle's Book, Etched by William Blake in 1782.</td>
<td>10</td>
</tr>
<tr>
<td>1.5</td>
<td>From <em>Introduction to Concepts and Theories in Physical Sciences</em>, by Gerald Holton and Stephen Brush.</td>
<td>11</td>
</tr>
<tr>
<td>1.6</td>
<td>A Right Angled Triangle.</td>
<td>13</td>
</tr>
<tr>
<td>1.7</td>
<td>Floor Tiling and Temple Columns on the Island of Delos.</td>
<td>14</td>
</tr>
<tr>
<td>1.8</td>
<td>Bronowski’s Caption To Page 159 Reads: &quot;Pythagoras Raised this Knowledge out of the World of Empirical Fact Into the World of What We Should Now Call Proof&quot;.</td>
<td>15</td>
</tr>
<tr>
<td>1.9</td>
<td>Charles Darwin’s study at Down House, Surrey, England.</td>
<td>19</td>
</tr>
<tr>
<td>1.10</td>
<td>‘Bruno’, photograph taken about 1944.</td>
<td>25</td>
</tr>
<tr>
<td>1.11</td>
<td>Bronowski’s eldest daughter Lisa Jardine from the cover of her book <em>Ingenious Pursuits</em> 1999.</td>
<td>27</td>
</tr>
<tr>
<td>1.12</td>
<td>Bronowski in his later years.</td>
<td>37</td>
</tr>
<tr>
<td>1.13</td>
<td>Niels Bohr broadcasting in the 1950 Open Letter.</td>
<td>39</td>
</tr>
<tr>
<td>1.14</td>
<td>The author at the pond of ashes at the Auschwitz prison camp.</td>
<td>43</td>
</tr>
<tr>
<td>1.15</td>
<td>The title page from the publication <em>The Ascent of Man</em>.</td>
<td>44</td>
</tr>
<tr>
<td>1.16</td>
<td>Dr Jacob Bronowski, who died in 1974. The artist was Felix Topolski.</td>
<td>47</td>
</tr>
<tr>
<td>2.1</td>
<td>Sir Philip Sidney, with his sister Mary, Countess of Pembroke.</td>
<td>59</td>
</tr>
<tr>
<td>2.2</td>
<td>A drawing of John Dryden, cover design from Selected Works of John Dryden, William Frost (ed).</td>
<td>66</td>
</tr>
<tr>
<td>2.3</td>
<td>A tinted drawing of William Wordsworth aged 36 (1806) by Henry Edridge.</td>
<td>69</td>
</tr>
<tr>
<td>2.4</td>
<td>A drawing of Coleridge, Lime Tree Bower Press, 1970.</td>
<td>79</td>
</tr>
</tbody>
</table>
Figure 2.5 A Sketch of Shelley from *The Life of Percy Bysshe Shelley* by Edward Dowden, 1969.

Figure 2.6 A photograph of Swinburne.

Figure 2.7 A cover reproduction of Yeats from a painting by Augustus John.

Figure 3.1 A page from Blake’s notebook, including self-portrait.

Figure 3.2 Abraham Maslow (1908 – 1970).

Figure 3.3 A page from Blake's early Prophetic Book *America*.

Figure 3.4 ‘Talk Softly, Please.’

Figure 3.5 Title *Infant Joy*.

Figure 3.6 Blake's etchings from *Songs of Innocence*.

Figure 3.7 Urizen, the master craftsman. Urizen or the Ancient Days, from Europe.

Figure 3.8 The first page from *Milton Book the First*.

Figure 3.9 Blake's *Mundane Shell*.

Figure 3.10 The little bridge over the river Severn at Coalbrookdale from *The Ascent of Man*.

Figure 3.11 John Wilkinson coinage.

Figure 3.12 Wedgwood Crockery.

Figure 3.13 Blake's etching for *Songs of Experience*.

Figure 3.14 *Songs of Experience*, *The Chimney Sweeper*.

Figure 3.15 *Songs of Innocence*, *The Nurse's Song*.

Figure 3.16 Jill Ker Conway.

Figure 4.1 Sheet Music for *Is You Is, Or Is You Ain't (Ma' Baby)*.

Figure 4.2 Photograph of Hiroshima Shows the Extent of the Destruction Which Must Have Been Similar to Nagasaki.

Figure 4.3 Newton watching the apple fall.

Figure 4.4 Leonardo da Vinci *Lady with an Ermine* Czartoryski Museum, Cracow

Figure 4.5 Photo of Szilard in *The Ascent Of Man*.
Figure 4.6 Dr Bronowski, President August B Kinzel, Dr Jonas Salk and Mrs Szilard at the Dedication of the Szilard Memorial Library 2 February 1967.

Figure 4.7 Salk Institute Building facades onto a courtyard. Photo by Donald Corner and Jenny Young.

Figure 4.8 Robert Frost and a copy of his poem Provide, Provide

Figure 4.9 Figure 4.9 John Berryman and His Poem Three Around the Old Gentleman.

Figure 5.1 Mussolini (R Bosworth, Uniview).

Figure 5.2 Mussolini and Hitler driving through France (R Bosworth, Uniview).

Figure 5.3 Max Born (Bronowski, The Ascent of Man p361)

Figure 5.4 Goose Girl, Göttingen (Bronowski, The Ascent of Man p363) which has the phrase They are here not to worship what is known, but to question it.

Figure 5.5 Poster for an Exhibition at the Art Gallery of Western Australia.

Figure 5.6 Four Nobel Laureates (Sarfaty Dissertation, p123) The four dissenters, Bohr, Franck, Einstein and Rabi.

Figure 5.7 The Resident and Non-Resident Fellows with President Frederic de Hoffmann at the Annual Meetings January 1974. Salk Newsletter following Bronowski’s death.

Figure 5.8 Salvador E Luria.

Figure 5.9 Christian de Duve Nobel Laureate, 1974, shared with Albert Claude and George Palade for The Structural and Functional Organization of the Cell (de Duve 1995 book cover).

Figure 5.10 Bertrand Russell Stanford, Encyclopaedia of Philosophy.

Figure 5.11 David Hilbert.

Figure 5.12 Kurt Godel.

Figure 5.13 Linus Pauling.

Figure 5.14 Werner Heisenberg.

Figure 5.15 Selma Lagerlöf (Encyclopaedia Britannica).
Figure 6.1  Bronowski with a Human Skull.  
Figure 6.2  Child Beginning to Walk (Bronowski, 1974).  
Figure 6.3  Michelangelo’s Carved Head of Brutus.  
Figure 6.4  Portrait of Paracelus.  
Figure 6.5  Joseph Priestley.  
Figure 6.6  Pythagoras’ Theorem.  
Figure 6.7  Nicolaus Copernicus as a young man in Torun, Poland.  
Figure 6.8  Portrait of Galileo Galilei drawn 8 years before his trial by Octavio Leoni.  
Figure 6.9  Bronowski at the Vatican Examining the Documents of Galileo’s Trial.  
Figure 6.10  Woolsthorpe Manor.  
Figure 6.11  Newton, with his prism and silent face.  
Figure 6.12  Einstein at the Age of Fourteen.  
Figure 6.13  A Cottage Interior 1896.  
Figure 6.14  The Labourer.  
Figure 6.15  Darwin in His Last Years.  
Figure 6.16  Wallace in His Garden 1905.  
Figure 6.17  Naturally Occurring Cubic Crystal of Common Salt.  
Figure 6.18  Dmitri Ivanovich Mendelev.  
Figure 6.19  PICASSO: Les Demoiselles D’Avignon 1907, p19 Lucy Norton.  
Figure 6.20  SEURAT: Woman Powdering Herself 1889-90, plate 42, Roger Fry.  
Figure 6.21  BRAQUE: Nude plate 17, 1907. Edwin Muellins.  
Figure 6.22  Bohr P152 Sarfatay.  
Figure 6.23  The First Historic Graphite Reactor.  
Figure 6.24  Fermi (Second Right) at the Unveiling of Plaque  
Figure 6.25  Boltzmann Memorial, p348, (Bronowski, 1973).  
Figure 6.26  X-Ray Diffraction Pattern Of Crystals Of DNA p357.  
Figure 6.27  Bronowski in the Ashes p375.  
Figure 6.28  Photo of Mendel p381.  
Figure 6.29  Ludwig Boltzmann And His Wife Henrietta In 1875.  

xi
Figure 6.30  James And Elizabeth Watson.  332
Figure 6.31  Albert Einstein And Second Wife.  333
Figure 6.32  Niels Bohr And Margrethe.  333
Figure 6.33  Photo of the Uzbeki’s (p426).  334
Figure 6.34  Photo of Erasmus (p427).  335
Figure 6.35  Photo of Blake’s Songs of Experience.  338
Figure 6.36  Dr Bronowski at home in his study February 1973.  340

Figure 7.1  Reg Butler Born 1913, Buntingford, Hertfordshire, England.  342
Died 1981, Berkhamstead.
Figure 7.2  Reg Butler trying to re-discover the ancient art of modelling.  342
Figure 7.3  Institute President Joseph Slater at Dr Bronowski’s sixtieth
birthday party January 1968, Rita Bronowski and Clare look
on. (Salk Institute Memorial Newsletter).
Figure 7.4  Dylan in his writing shed, 1953.  349
Figure 7.5  Family photograph, September 1953: Dylan, Llewelyn,
Aeronwy, Mrs DJ Thomas, Colm and Caitlin.
Figure 7.6  Frost in England, 1913.  351
Figure 7.7  WH Auden and Frost in Oxford, 1957.  351
Figure 7.8  Frost with Nikita Khrushchev in Russia, 1962.  352
Figure 7.9  The factors that shape things.  362
Figure 7.10 Bronowski specifies “Lincoln Cathedral is such a creation.”  367
Figure 7.11 The Circus in Bath.  367
Figure 7.12 Crystal Palace. (Bronowski, 1955, p51).  367
Figure 7.13 Sir Oswald Hornby Joseph Birley British, 1880-1952.  371
Figure 7.14 Acheulian cleaver (flint hand axe) from the Somme Valley,
Cagny, Route de Boves, France. Peabody Museum, Harvard
University. Photographed by Hillel Burger.
Figure 7.15 The 1925 Model T Ford. Ford Motor Company  375
Figure 7.16 Dancing Ganesa, Bengal tenth or eleventh century (black
basalt, 95.2cm high) Pan Asian Collection, Los Angeles
County Museum of Art.
Figure 7.17 Fatata te Miti [By the sea], Paul Gauguin. Chester Dale
Collection, National Gallery of Art, Washington, DC.
Figure 7.18  Tablet with Sumerian ideograms. Babylonian Collection, Yale University.

Figure 7.19  *The Tyger*, from *Songs of Experience* (London, 1794) by William Blake.

Figure 7.20  *Rue des Moulins* (1894), Henri de Toulouse-Lautrec. Chester Dale Collection, National Gallery of Art, Washington, DC

Figure 7.21  *A Tilbury Shelter Scene* 1940-41, Henry Moore. The Tate Gallery, London.

Figure 7.22  Self Portrait, Rembrandt van Rijn. Widener Collection, National Gallery of Art, Washington, DC.

Figure 7.23  Self Portrait, Vincent van Gogh. Chester Dale Collection, National Gallery of Art, Washington, DC. (No date)

Figure 7.24  *Queen Zenobia Addressing Her Soldiers*, Giovanni Battista Tiepolo. Samuel H Kress Collection, National Gallery of Art, Washington, DC. (No date)

Figure 7.25  *Les Paraplites*, Pierre August Renoir. Reproduced courtesy of the Trustee, The National Gallery, London.

List of Tables

Table 2.1  An adaptation of the plan of Bronowski’s Study of the eight poets of *the Poet’s defence*. 

xiii