

## **Project Plan Narrative**

University of California – Historically Black Colleges and Universities Initiative  
*Summer Research Internship Support Grant*

*Astrobiological Prestudies (Gibson, Carl H.)*

### **Abstract**

A UC-HBCU grant is requested to assist undergraduate and masters level HBCU Interns to achieve their professional and academic goals by attending summer school classes at UCSD along with graduate students in the UCSD Astrobiology Studies program, and by also attending a NASA sponsored scientific meeting in San Diego on Astrobiology organized by NASA scientist Richard Hoover (the 14<sup>th</sup> in a sequence). Hoover has recently published a paper in the Journal of Cosmology claiming extraterrestrial life fossils in three meteorites. Students will attend a workshop to prepare research publications on Astrobiological Science for the Journal of Cosmology or equivalent refereed journal, mentored by UCSD faculty and graduate students as co-authors and referees, all committed to the several months of communication usually required to complete a publishable paper. The program is intended to provide pathways to graduate admissions in the broad range of science and engineering fields, and by exposure to fundamental science and engineering disciplines needed by Astrobiologists. A three year UC-HBCU Astrobiological Studies program is proposed: 2011, 2012 and 2013. Interns would be eligible to enter this program when they become advanced graduate students. A center of excellence in astrobiology is planned for UCSD similar to that Directed by Professor Wickramasinghe for many years with Fred Hoyle at Cardiff University, <http://www.astrobiology.cf.ac.uk/chandra1.html>. Professor Wickramasinghe's CV is attached as Appendix 1. Figures A2-1,2 of Appendix 2 compare Astrobiology timelines of modern fluid mechanical and astrobiological models of Gibson/Wickramasinghe/Schild of the Journal of Cosmology with standard NASA- $\Lambda$ CDMHC models. NASA support will be sought to support research and educational aspects of both initiatives. Overload teaching of up to two courses a year by UCSD faculty of key astrobiology courses at either UCSD or at HBCU campuses is authorized by recent guidelines of UCSD Senior Vice Chancellor Subramani for Academic Affairs, following recommendations of Dean Seible of the UCSD Jacobs School of Engineering. Appendix 3 summarizes how this proposal will meet the goals of the UCOP initiatives.

### **Introduction**

UCSD has a long history of astrobiological studies, starting with the classic experiments of Harold Urey and Stanley Miller at UCSD that created amino acids by simulating conditions of early Earth in a chemistry laboratory. Fifty years of exhaustive efforts have shown little progress toward terrestrial abiogenesis, where life is created in the laboratory from inorganic chemicals. This supports the

Hoyle/Wickramasinghe hypothesis that life was not, and could not be, created on Earth but is transmitted by means of cometary panspermia between planets. How this works has been highly controversial. See the most recent reports in Nature

<http://www.nature.com/news/2011/110317/full/news.2011.165.html>.

From standard cosmology where planets are produced in small numbers by stars it appears that life anywhere in the universe is impossible and either new cosmology or numerous miracles are required.

Cometary panspermia has had great difficulty finding acceptance by the scientific community. Mechanisms for transferring the seeds of life by means of comets and meteors are extremely unlikely by standard cosmological, astrophysical and astronomical methods. However, these mechanisms are easy to understand and natural to expect using the Gibson (1996)/Schild (1996) hydrogravitational dynamics HGD cosmology, where the dark matter of galaxies is primordial planets in clumps that provide the raw material for all stars. According to HGD cosmology, thirty million ( $3 \times 10^7$ !) earth-mass planets exist per star in all galaxies (not 8!). The planets are mostly frozen hydrogen and  $^4\text{helium}$  gases in primordial proportions, from which all stars are formed by planet mergers. Life chemicals such as water, iron, silicon, carbon, hydrogen, oxygen, nitrogen etc. are produced by the stars and scattered back to the planets when the continually growing stars explode. The planets have formed water oceans and hosted life formation for 99.99% of the age of the universe. Comets and meteors produced by planet mergers transmit the seeds of life to other planets.

Astrobiological studies demand a broad range of fundamental skills, particularly in fluid mechanics and oceanography. Students in the program are expected to enroll in UCSD Summer School 2011 courses in Introductory Fluid Mechanics MAE 101A and STPA 35 Society and the Sea taught by Carl H. Gibson, plus whatever other background courses fit their future goals. Teaching assistants for these courses are supported to mentor HBCU students both in course materials and in preparing for graduate student research. TAs will have had exposure to Astrobiological concepts in MAE 221B (Winter 2011, C. Gibson) and will mentor students preparing their research papers during the Astrobiology workshop taught by C. H. Gibson and N. C. Wickramasinghe.

## **Background**

Cosmology now recognizes that the Earth is not the center of the universe, following the work of Copernicus. However, it is still generally believed that life originated on Earth and may be confined to this planet. Such beliefs should soon evaporate as the flood of new astrophysical information from space telescopes in all frequency bands arrives. The standard model of cosmology is in the process of disintegrating; that is, the dark-energy, cold-dark-matter hierarchical-clustering  $\Lambda\text{CDMHC}$  model. Life

anywhere in the universe could not possibly have developed following this model, where the first star does not appear until 300 million years after the big bang, and it is assumed that only a handful of planets per star exist.

Fluid mechanical concepts employed in the development and defense of the standard (NASA- $\Lambda$ CDMHC) model are appallingly bad. Most of the mass-energy of the universe is claimed to be anti-gravitational, causing repulsive acceleration starting a billion years ago. The anti-gravity  $\Lambda$  required by Einstein's equations to permit the big bang is fluid mechanical, caused by turbulence, and is not permanent but temporary, dissipating in  $10^{-27}$  seconds (Gibson 2004, 2005). The Jeans 1902 gravitational instability theory neglects viscosity, turbulence, fossil turbulence, and the extreme diffusivity of the non-baryonic neutrino-like dark-matter component. Cold-dark-matter therefore cannot condense and its condensed seeds cannot hierarchically cluster. Hydrogravitational dynamics concepts (Gibson 1996) are needed. The origin of life on primordial planets is the basis of new Astrobiology (Gibson, Schild & Wickramasinghe 2011).

What happens is that the plasma of hydrogen and helium-4 produced by nucleosynthesis fragments at a large viscous scale about 30 Kyr ( $10^{12}$  seconds) after the big bang, producing protosuperclusters and protosuperclustervoids. Protogalaxyclusters and finally protogalaxies fragment in the expanding universe until the plasma turns to gas at 300 Kyr ( $10^{13}$  seconds). The protogalaxies then fragment at two scales, a million solar mass acoustic scale and a viscous earth-mass scale. The hot-gas planets merge to form stars that explode to form the first chemicals. The chemicals are collected gravitationally by the hot hydrogen planets. Iron is reduced to metallic form at the core and oceans of hot water form at 2 Myr when temperatures cool to 647 K (705 F), the critical temperature of water (Gibson, Wickramasinghe and Schild 2010); ideal conditions for rapid organic chemistry to begin and be spread in the chemically seeded cosmological soup on  $10^{80}$  planets of hot hydrogen with critical temperature oceans formed by the big bang. The critical-freezing water temperature period 2-8 Myr is termed the biological big bang (GWS 2010).

### **Project Plan**

A brochure will be prepared as soon as funds are available, to be distributed to HBCU institutions describing the program and application procedures. Seminars by Gibson and Wickramasinghe will be given at HBCU locations expressing interest in the program to recruit participants. Successful candidates will be contacted so they can register for UCSD summer session courses and the SPIE conference on Astrobiology. A project secretary will be appointed to coordinate logistics and keep records. The Editorial Board of the Journal of Cosmology is Schild (Editor in Chief), Wickramasinghe, and Gibson (Founding Editor in Chief). Richard Hoover of the NASA Marshall Space Flight Center in Huntsville, Alabama, has a very well received article in the most recent edition of the Journal of Cosmology (15 million hits in 7

days), and has experience and contacts in the HBCU community. NASA has a long history of HBCU outreach programs, which we expect to exploit and extend. The timing for NASA support of Astrobiology and education is now (2011) with the complete cancellation of the \$9B Bush administration Constellation program by the Obama administration favoring education and innovation over manned flight. Overload teaching of up to two courses a year by UCSD faculty of key astrobiology courses at HBCU campuses with NASA or other support is authorized by UCSD SVCAA guidelines, following recommendations by the UCSD Jacobs School of Engineering.

### References

- Gibson, C.H. 1996. Turbulence in the ocean, atmosphere, galaxy and universe, Appl. Mech. Rev., 49, no. 5, 299–315.
- Gibson, C. H. 2004. The first turbulence and the first fossil turbulence, Flow, Turbulence and Combustion, 72, 161–179.
- Gibson, C. H. 2005. The first turbulent combustion, Combust. Sci. and Tech., 177:1049–1071, arXiv:astro-ph/0501416.
- Gibson, C. H., Schild, R. E, and Wickramasinghe, N. C. 2011. The Origin of Life from Primordial Planets, International Journal of Astrobiology (2011), 10: 83-98 , doi:10.1017/S1473550410000352, arXiv:1004.0504
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### Appendix 1

#### CURRICULUM VITAE

##### ***Professor Nalin Chandra Wickramasinghe***

BSc (Ceylon), MA, PhD, ScD (Cantab), Hon DSc (Soka-Tokyo), Hon DSc (Sri Lanka: Ruhuna Univ), FRAS, FRSA, FIMA, CMath

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**Personal Details:**

Date of Birth: January 20, 1939

Place of Birth: Colombo, Sri Lanka

Nationality: British *and* Sri Lankan

**Education:**

Royal College, Colombo, 1950-1957

University of Ceylon, 1957-1960

First Class Honours in BSc Special Mathematics Examination, 1960

Awarded Commonwealth Scholarship, 1960

University of Cambridge, 1960-1963

PhD in Astrophysics, 1963

ScD, 1973

**Awards etc:**

Powell Prize for English Poetry, Trinity College, Cambridge, 1962

International Dag Hammarskjold Gold Medal for Science, 1986

Scholarly Achievement Award of the Institute of Oriental Philosophy, Japan, 1988

Awarded title of *Vidya Jyothi* (Sri-Lanka National Honour), 1992

Sahabdeen International Award for Science, 1996

Honorary Doctorate of Soka University, Tokyo, 1996

John Snow Medal, Association of Anaesthetists of Great Britain and Ireland, 2004

Honorary DSc (Sri Lanka: Ruhuna University) 2004

***Asian Power 100 list (2005) named Chandra Wickramasinghe as one of the 100 most influential Asians living in the UK***

**Present Positions:**

Director of the Cardiff Centre for Astrobiology, Cardiff University;

Professor in Astrobiology, Cardiff University, since 2006

Emeritus Professor of Applied Mathematics and Astronomy, Cardiff University

Honorary Professor, Glamorgan University, UK

Editorial Board Member of *Astrophysics and Space Science*

Editorial Board Member of *Journal of Scientific Exploration*

Editor of Astrobiology for internet journal [JournalofCosmology.com](http://JournalofCosmology.com)

Team member of European Space Agency's *Rossetta Mission*

**Previous Positions:**

Research Fellow, California Institute of Technology, 1965

Professor of Mathematics, Vidyodaya University of Ceylon, 1966

Visiting Professor at Universities of Arizona and Maryland USA, 1966-1970

Visiting Professor at Yukawa Institute, Kyoto University, Japan, 1969

Fellow of Jesus College, Cambridge; Tutor, Jesus College, Cambridge and College Supervisor in Mathematics; Member of the Graduate Staff of the Institute of Theoretical Astronomy, University of Cambridge, 1966-1973

Visiting Professor at the University of Western Ontario, London, Ontario, Canada, 1974 and 1976

Director, Institute of Fundamental Studies, Sri Lanka, 1982-1984

UNDP Consultant/Advisor to the President of Sri Lanka, 1982-1984

Visiting Professor at Institute of Space and Astronautical Studies, Japan, 1993

Visiting Professor, University of the West Indies, Mona, Kingston, 1994

Professor and Head of the Dept. of Applied Maths and Astronomy, Univ. Coll., Cardiff, 1973-89

Professor of Applied Mathematics and Astronomy 1990-2006

### **Research Interests:**

Interstellar Matter, Infrared Astronomy, Light Scattering Theory, Applications of Solid State Theory to Astronomy, The early Solar System, Comets, Astrochemistry and the Origins of Life, Astrobiology

### **Endowed Lectures (recent)**

*Joule Millennium Lecturer, University of Salford, 2000*

*Alfred Curtis Memorial Lecture, British Astronomical Association, 2002*

*Flamsteed Lecture, University of Derby, 2002*

*Sujatha Jayawardene Memorial Oration, University of Colombo Alumni Association, 2004-09-*

*27 John Snow Memorial Lecture, Association of Anaesthetists of Great Britain and Ireland (2004)*

### **Books:**

*Interstellar Grains: Chapman & Hall, London, 1967*

*Light Scattering Functions for Small Particles with Applications in Astronomy: J. Wiley, 1973*

*Solid-State Astrophysics: (ed with D.J. Morgan) D. Reidel Co., 1975*

*Interstellar Matter: (with F.D. Khan & P.G. Mezger) Swiss Astron.Soc., 1974*

*Cosmic Laboratory: University College, Cardiff Press, 1975*

*Lifecloud: The Origin of Life in the Galaxy: (with Fred Hoyle) J.M. Dent, Lond., 1978*

*Diseases from Space: (with Fred Hoyle) J.M. Dent, Lond., 1979*

*Origin of Life: (with Fred Hoyle) University College Cardiff Press, 1979*

*Space Travellers: The Bringers of Life: (with Fred Hoyle) University College Cardiff Press, 1981*

*Evolution from Space: (with Fred Hoyle), J.M. Dent, 1981*

*Is Life an Astronomical Phenomenon?: University College, Cardiff Press, 1982*

*Why Neo Darwinism does not Work: (with Fred Hoyle) University College Cardiff Press, 1982*

*Proofs that Life is Cosmic: (with Fred Hoyle) Inst. of Fund.Studies, Sri Lanka, Mem, No. 1, 1982*

*From Grains to Bacteria: (with Fred Hoyle) University College, Cardiff Press, 1984*

*Fundamental Studies and the Future of Science: (editor) University College Cardiff Press, 1984*

*Living Comets: (with Fred Hoyle) University College, Cardiff Press, 1985*

*Viruses from Space: (with F. Hoyle and J. Watkins), University College Cardiff Press, 1986*

*Archaeopteryx - The Primordial Bird: A Case of Fossil Forgery: (with Fred Hoyle) Christopher Davies, Swansea, 1986*

*Cosmic Life Force: (with Fred Hoyle), J.M. Dent, Lond., 1988*

*The Theory of Cosmic Grains: (with F. Hoyle), Kluwer Academic Publishers, 1990*

*Our Place in the Cosmos: (with Fred Hoyle) Weidenfeld and Nicholson, Lond., 1993*

*The Wonders of Life and the Universe (with Daisaku Ikeda) Mainichi Press, 1992, 1993*

*Glimpses of Life, Time and Space (a book of poems) Writers' Workshop, Redbird, 1994*

*Life of Mars: The Case for a Cosmic Heritage: (with Fred Hoyle) Clinical Press, 1997*

*Space and Eternal Life (a dialogue with Daisaku Ikeda) Journeyman Press, 1997*

*Astronomical Origins of Life: Steps towards panspermia* (with F. Hoyle) Kluwer Academic Press, 2000

*Cosmic Dragons: Life and Death on Our Planet.* Souvenir Press, 2001

*Fred Hoyle's Universe* (eds with G. Burbidge and J.V. Narlikar) Kluwer Academic Publ. 2003

*A Journey with Fred Hoyle: The search for cosmic life,* World Scientific and Imperial College Press, 2004

*Comets and the Origin of Life* (with J.T. Wickramasinghe and W.M. Napier), World Scientific and Imperial College Press, 2009

**Endowed Lectures (recent)**

*Joule Millennium Lecturer, University of Salford, 2000*

*Alfred Curtis Memorial Lecture, British Astronomical Association, 2002*

*Flamsteed Lecture, University of Derby, 2002*

*Sujatha Jayawardene Memorial Oration, University of Colombo Alumni Association, 2004-09-*

*27 John Snow Memorial Lecture, Association of Anaesthetists of Great Britain and Ireland (2004)*

**List of Technical Papers**

1. "A note on the origin of the Sun's polar field", F.Hoyle and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **123**,51,1962
2. "On graphite particles as interstellar grains", F. Hoyle and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **124**,417,1962
3. "A note on interstellar polarization by graphite flakes", N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **125**, 87,1962
4. "On graphite particles as interstellar grains II", N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **126**, 99,1963
5. "On the deficiency in the ultraviolet fluxes from early type stars", F.Hoyle and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **126**, 401,1963
6. "Interstellar extinction by graphite grains", N.C. Wickramasinghe and C. Guillaume, *Nature*, **207**, 366,1965
7. "On the growth and destruction of ice mantles on interstellar graphite grains", N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **131**,177,1965
8. "A mechanism for mass ejection in red giant stars", B. Donn, T.P. Stecher and N.C. Wickramasinghe, *Ap.J.*, **146**,590,1966
9. "A note on the vapour pressure of a crystal", N.C. Wickramasinghe, *Proc.Camb.Phil.Soc.*, **59**,255,1963
10. "A survey of recent interstellar reddening observations", K.Nandy and N.C. Wickramasinghe, *Pub.Roy.Obs.Edin*, **5**, No.3, 1965
11. "Light scattering by graphite core-ice mantle grains", N.C. Wickramasinghe, M.W.C. Dharmawardene and C. Wyld, *Mon.Not.Roy.Astr.Soc.*, **134**,25,1966
12. "On the frequency distribution of ice grains sizes", N.C. Wickramasinghe, W.D. Ray and C. Wyld, *Mon.Not.Roy.Astr.Soc.*, **132**,137,1966
13. "On the optics of small graphite spheres, I", N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **131**, 263,1966
14. "On the optics of small graphite spheres, II", K.S. Krishna Swamy and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **132**,193,1966
15. "On the optics of small graphite spheres,III", C. Grevesse-Guillaume and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*,**132**,471,1966
16. "Comments on the intrinsic polarization of Mira variables", B.Donn, T.P. Stecher, N.C. Wickramasinghe and D.A. Williams, *Ap.J.*, **145**,949,1966

17. "The wavelength dependence of interstellar polarization by graphite grains", N.C. Wickramasinghe, B.Donn, T.P. Stecher and D.A. Williams, *Nature*, **212**, 167,1966
18. "Unified model for interstellar extinction and polarization", N.C. Wickramasinghe and K.S. Krishna Swamy, *Nature*, **213**, 895, 1967
19. "On the formation of graphite grains in cool stars", B.Donn, N.C. Wickramasinghe, J.P.Hudson and T.P.Stecher, *Ap.J.*, **153**, 451,1968
20. "Graphite grains and graphite core-ice mantle grains", N.C. Wickramasinghe, in *Interstellar Grains*, ed. by J.M. Greenberg and T.P. Roark, *NASA SP-140*, Washington, 1967
21. "Wavelength dependence of the position angle of interstellar polarization", J.G. Ireland, K. Nandy, V.C.Reddish and N.C. Wickramasinghe, *Nature*, **212**, 990,1966
22. "Impurities in interstellar grains", F.Hoyle and N.C.Wickramasinghe, *Nature*, **214**, 969,1967
23. "Evidence for lattice bands in interstellar grains", N.C. Wickramasinghe, *Nature*, **216**, 249,1967
24. "Origin of the diffuse interstellar bands", N.C. Wickramasinghe, J.G. Ireland, K. Nandy, H. Seddon and R.D. Wolstencroft, *Nature*, **217**, 412,1968
25. "Condensation of the planets", F.Hoyle and N.C. Wickramasinghe, *Nature*, **217**, 415,1968
26. "Microwave background in a steady-state universe", J.V. Narlikar and N.C. Wickramasinghe, *Nature*, **216**,43,1968
27. "Interpretation of the cosmic microwave background", J.V. Narlikar and N.C. Wickramasinghe, *Nature*, **217**, 1235,1968
28. "On the temperature of interstellar grains", K.S. Krishna Swamy and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **139**, 283,1968
29. "Comments on the possibility of interstellar quartz grains", K.S. Krishna Swamy and N.C. Wickramasinghe, *Ap.J.*, **154**,297, 1968
30. "Interstellar extinction by quartz grains", K.S. Krishna Swamy and N.C. Wickramasinghe, *Nature*, **217**, 1236, 1968
31. "On the formation of graphite particles in the atmospheres of Mira variables", N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **140**,273,1968
32. "Stimulation of interstellar OH by phonons", N.C. Wickramasinghe, *Nature*, **217**, 1131,1968
33. "Accretion of solid hydrogen mantles by grains in OB associations", V.C. Reddish and N.C. Wickramasinghe, *Nature*, **218**, 661, 1968
34. "Interpretation of the diffuse galactic light", N.C. Wickramasinghe, *Nature*, **218**, 1039, 1968
35. "Solid hydrogen and the microwave background", F.Hoyle, N.C. Wickramasinghe and V.C. Reddish, *Nature*, **218**, 1124, 1968
36. "Chemical sputtering of ice grains and mantles in HII regions", N.C. Wickramasinghe and D.A. Williams, *Observatory*, **88**, 272, 1968
37. "Condensation of dust in galactic explosions", F. Hoyle and N.C. Wickramasinghe, *Nature*, **218**, 1127, 1968
38. "Colour centres in interstellar grains", N.C. Wickramasinghe, K. Nandy, H. Seddon, R.D. Wolstencroft and J.G. Ireland, *Nature*, **218**, 1236, 1968
39. "Extinction curves for graphite particles coated with solid hydrogen", K.Nandy and N.C. Wickramasinghe, *Nature*, **219**, 1347, 1968
40. "Graphite particle model for NML Cygnus", K.S. Krishna Swamy and N.C. Wickramasinghe, *Nature*, **220**, 896, 1968



41. "Localised interstellar molecular hydrogen", V.C. Reddish and N.C. Wickramasinghe, *Nature*, **220**, 463,1968
41. "Chemical exchange reactions and H<sub>2</sub> formation in dark interstellar clouds", P. Solomon and N.C. Wickramasinghe, *Nature*, **220**, 1214,1968
42. "Interstellar dust and diamonds", N.C. Wickramasinghe, *Nature*, **222**, 154,1969
43. "Interstellar dust", B.T. Lynds and N.C. Wickramasinghe, *Ann Rev. Astron. Astrophys.*, **6**, 215,1968
44. "On interstellar abundance anomalies", N.C. Wickramasinghe, *Observatory*, **88**,246,1968
45. "A spectral feature of grains at 10 microns?", K.S. Krishna Swamy and N.C. Wickramasinghe, *Observatory*, **89**, 55,1969
46. "Strengths of the fundamental bands of ice and solid hydrogen in composite grains", K.S. Krishna Swamy and N.C. Wickramasinghe, *Observatory*, **89**, 57,1969
47. "Star formation in clouds of solid hydrogen grains", V.C. Reddish and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **143**, 189,1969
48. "Solid hydrogen coated graphite particles in the interstellar medium I", K.S. Krishna Swamy and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **144**,41,1969
49. "Alignment of interstellar grains by cosmic rays", E.E. Salpeter and N.C. Wickramasinghe, *Nature*, **222**, 442, 1969
50. "Interstellar grains", F.Hoyle and N.C. Wickramasinghe, *Nature*, **223**, 459, 1969
51. "Molecular and solid hydrogen in dense interstellar clouds", P.M. Solomon and N.C. Wickramasinghe, *Ap.J.*, **158**,449, 1969
52. "Infrared radiation from dust in Seyfert galaxies", M.J. Rees, J.I. Silk, M.W. Werner and N.C. Wickramasinghe, *Nature*, **223**, 778, 1969
53. "Wavelength dependence of polarization XVIII. Interstellar polarization and composite interstellar particles", G.V. Coyne and N.C. Wickramasinghe, *Astron.J.*, **74**, 1179,1969
54. "Extinction curves for graphite-silicate grain mixtures", N.C. Wickramasinghe, *Proc. IAU Symposium No.36* (eds Houziaux and Butler), p.42,1970
55. "Graphite-silicate grain mixtures and the diffuse galactic light", N.C. Wickramasinghe, *Publ.Astro.Soc.Japan*, **22**, 85,1970
56. "Interstellar polarization by graphite-silicate grain mixtures", N.C. Wickramasinghe, *Nature*, **224**, 656, 1969
57. "The shape of the interstellar 4430A absorption band", K.Nandy and N.C. Wickramasinghe, *Astrophys.Sp.Sci.*,**6**,154,1970
58. "Retention of dust grains near galactic nuclei", N.C. Wickramasinghe, *Nature*, **225**, 145,1970
59. "Dust in supernova explosions", F.Hoyle and N.C. Wickramasinghe, *Nature*, **226**, 62,1970
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61. "Interstellar extinction by graphite, iron and silicate grains", K.Nandy and N.C. Wickramasinghe, *Nature*, **227**, 51,1970
62. "Radio waves from grains in HII regions", F.Hoyle and N.C. Wickramasinghe, *Nature*, **227**, 473, 1970
63. "Small dust grains and the heating of HI clouds", N.C. Wickramasinghe, *Nature*, **227**, 587, 1970
64. "Galactic component of the diffuse X-ray background", N.C. Wickramasinghe, *Nature*, **227**, 265,1970

65. "Galactic soft X-rays and the alignment of interstellar grains", N.C. Wickramasinghe, *Nature*, **228**, 540,1970
66. "Reply to Mack and Webster", N.C. Wickramasinghe, *Nature*, **228**, 544,1970
67. "Interstellar dust-graphite, iron and silicates", N.C. Wickramasinghe and K. Nandy, *Nature Physical Science*, **229**, 81,1971
68. "Dust clouds in space", N.C. Wickramasinghe, *Science Journal*, **6**, 46, 1970
69. "Polarization within the 4430A absorption band", K.Nandy and N.C. Wickramasinghe, *Nature Physical Science*, **229**, 234, 1971
70. "Enstatite grains and the 2200A interstellar extinction feature", K. Nandy and N.C. Wickramasinghe, *Nature Physical Science*, **230**, 16,1971
71. "Interstellar dust- reply to Duley's criticisms", N.C. Wickramasinghe and K. Nandy, *Nature Physical Science*, **230**, 24,1971
72. "A model for cosmic infrared sources", N.C. Wickramasinghe, *Nature Physical Science*, **230**, 116,1971
73. "Optical properties of graphite-iron-silicate grain mixtures", K.Nandy and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **153**,205,1971
74. "Dust in the Orion nebula", K.Nandy and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*,**154**, 255,1971
75. "Strong infrared galaxies", N.C. Wickramasinghe, *Science Journal*, 17 June 1971
76. "Irradiated quartz particles as interstellar grains", N.C. Wickramasinghe, *Nature Physical Science*, **234**, 7,1971
77. "Recent work on interstellar grains", N.C. Wickramasinghe & K.Nandy, *Rep. Progress Phys.*, **35**, 157,1972
78. "On the injection of grains into interstellar clouds", N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **159**, 269,1972
79. "Radiation-driven efflux and circulation of dust in spiral galaxies", R.Y. Chiao and N.C. Wickramasinghe, *Mon.Not.Roy.Astr.Soc.*, **159**, 361, 1972
80. "Dust models for infrared galaxies", N.C. Wickramasinghe, *Mem. Soc. Roy.Sci. Liege*, 6 series, tome III, p.601, 1972
81. "The expulsion of dust from galaxies", R.Y. Chiao and N.C. Wickramasinghe, *Astrophys. Lett.* **14**, 19,1973
82. "Extinction and scattering by small planetesimal particles", K.Nandy and N.C. Wickramasinghe, *Astrophys.Sp.Sci.*,**23**, 51,1973
83. "The 2200A extinction feature and the shape distribution of graphite grains", N.C. Wickramasinghe and K. Nandy, *Astrophys. Sp.Sci.*, **26**, 123,1974
84. "Electric charge and acceleration of suprathemal grains", N.C. Wickramasinghe, *Astrophys. Sp. Sci.*, **28**, 25, 1974
85. "Extinction and polarization models", N.C. Wickramasinghe, *Solid State Astrophysics* (ed. N.C. Wickramasinghe and D.J. Morgan, 1976)
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### Appendix 2, Astrobiology from Genome size and HGD primordial planets

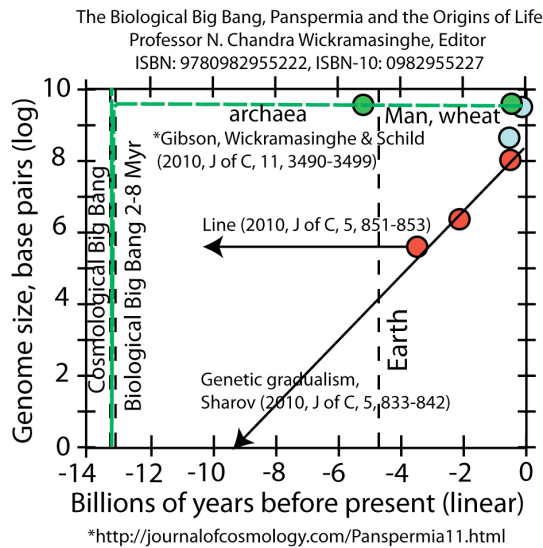


Fig. A2-1 Genome size versus time (Sharov 2010) suggests evolutionary time scales exceed the age of the Earth (4.6 Gyr).

Astrobiology according to Gibson/Wickramasinghe/Schild begins at 2-8 Myr. According to NASA and  $\Lambda$ CDMHC cosmology, life is impossible.

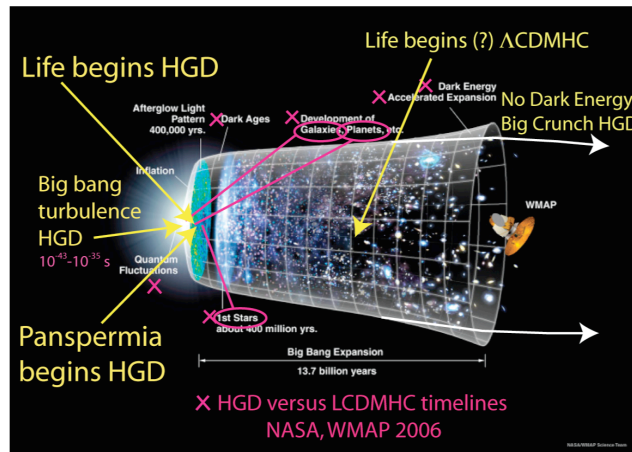


Fig. A2-2 NASA- $\Lambda$ CDMHC Astrobiological and cosmological timelines versus Gibson/Wickramasinghe/Schild hydrogravitational dynamics HGD timelines. Life according to NASA- $\Lambda$ CDMHC is virtually impossible because primordial hydrogen planets are not produced to make stars, chemicals, oceans and the first life at 2 Myr (the time when C,N,O-seeded oceans condense, at critical temperature 705 F).

### Appendix 3, REVIEW CRITERIA

1) Strength of UC faculty commitment and involvement in activities and goals of the project plan (level, type and frequency of involvement in project) and ability to successfully implement project plan.

*Faculty at UCSD are strongly committed to the goals of the UC-HBCU initiatives.*

2) Departmental support of project and history of effort and impact on behalf of graduate academic diversity.

*Department Chairs of MAE and SIO have encouraged faculty participation by teaching and mentoring UC-HBCU Scholars and Interns.*

3) Commitment of HBCU faculty partner(s) to the project (endorsement or letters of support/partnership will greatly strengthen an application).

*Such endorsements are being sought, especially from HBCUs near NASA facilities.*

4) Quality of project plan, support faculty and other mentors for student interns

*The plan is to engage UCSD faculty and their graduate students to mentor student interns.*

5) Follow up mentoring plan for summer research interns.

*HBCU scholars and interns are required to identify a research project and write a report about it in the form of a paper or papers for the Journal of Cosmology, with mentor and faculty coauthors. Normally papers require collaboration of authors for several months to reach publishable quality.*

6) Indicators of building long term sustainability between UC and identified HBCU(s)

*Peer reviewed research publications by the scholars and interns are considered the best measure of success.*

7) Strength, and likelihood of effectiveness, of graduate admission pathways to improve inclusion of HBCU scholars in UC PhD programs as well as identified steps to institutionalize such efforts within a department to enhance long term success.

*Astrobiological studies and Astrobiological prestudies will provide HBCU scholars and interns a solid education in the fundamentals of science and engineering needed for progress in the rapidly evolving field of astrobiology or in related fields such as astromedicine (see Hoyle/Wickramasinghe publications). Astrobiology is at a tipping point due to the flood of information from new spacecraft about the cosmology, and from strong evidence of extraterrestrial life from meteorites and comets. Research support from NASA and other affected specialties should be forthcoming for all participants in the present program.*

**Update:** Professor Wickramasinghe has shifted the Cardiff Center for Astrobiology from Cardiff University, UK, to Buckingham University, UK. See <http://www.buckingham.ac.uk/research/bcab> for details. Astrobiology activities at UCSD through the UC-HBCU program will be coordinated with those carried out at the Buckingham Center for Astrobiology. The Journal of Cosmology is committed to assisting in every way the research and education of Astobiology students at BCAB and UC-HBCU.