## Index

2001: A Space Odyssey, 206, 369  
A Brief History of Time, 348  
Abell, George, 255  
Acasta gneiss formation, 83  
Accretion, 204, 245, 249, 250, 252  
Acetylene, 184  
Acetylene cycle, 184  
Agassis, Louis, 179  
ALH 84001 meteorite, 26, 27, 51, 91, 94, 112, 127, 180, 189, 212, 340, 350  
Allen, David, 294  
Allen, Paul, 313  
Allen Telescope Array, 311, 312, 313, 315, 322  
Allende meteorite, 221  
Alpha Centauri, 264, 268, 272, 273  
Alternative biologies, 173, 195, 353  
Alvarez hypothesis, 114, 117  
Alvin submersible, 104  
Amino acid, 64, 126, 139, 211, 271, 351  
Ammonia, 61, 64, 77, 108, 111, 184, 192  
Amoeba, 162  
Analog Science Fiction Magazine, 367  
Ancestor simulation, 345  
Anderson, Donald, 115  
Andretti, Mario, 368  
Animal  
behavior, 144, 148, 155  
brain size, 157  
cognition, 145, 156  
communication, 152  
consciousness, 163  
culture, 160  
intelligence, 155  
language, 156  
learning, 147, 151  
memory, 150  
self-awareness, 156, 163  
social behavior, 159  
transmitted knowledge, 160  
Antarctic dry valleys, 103, 169  
Antarctica, 176  
Anthropic principle, 60, 334, 337, 343, 354  
Anthropic reasoning, 335, 342, 344, 364  
Apollo program, 36, 37, 47, 55, 193, 371, 372  
Archean era, 82, 105  
Aristotle, 10, 23, 24  
Arthropod, 135  
Artificial intelligence, 330, 331, 335, 338, 346  
Artificial signal, 309, 313, 318  
Asimov, Isaac, 28, 72, 179, 366  
Asteroid, 206, 211, 220, 222  
Astounding Stories of Super Science, 367  
Astrobiology: A Multidisciplinary Approach, 190  
Astronaut, 42, 43, 56, 57, 372  
Astronomer Royal, 365  
Atacama desert, 174, 175, 238  
ATP, 108  
Augmented reality, 332  
Avatar, 332  
Bacteria, 18, 28, 63, 88, 89, 90, 91, 99, 105, 106, 119, 120, 127, 128, 129, 131, 139, 164, 175, 271, 297, 301, 351, 375, 384  
Bains, William, v, viii, 69  
Barite, 90  
Baross, John, v, viii, 73, 102  
Bayesian probability theory, 342  
Behavioral ecology, 144, 157  
Belief systems, 186  
Bell, Alexander Graham, 372  
Bell Burnell, Jocelyn, 311, 320

© in this web service Cambridge University Press  www.cambridge.org
Index

Dawkins, Richard, 35
de Duve, Christian, 21
Deep Impact spacecraft, 200, 203
Deinococcus radiodurans, 96, 97
Denning, Kathryn, 155
Diatom, 138
Dick, Steven, viii, 22
Dickens, Charles, 384
Dinosaurs, 53, 125
Disk instability, 243, 250, 251, 252
DNA, 18, 20, 33, 52, 59, 60, 63, 64, 65, 74, 95, 96, 97, 98, 99, 100, 101, 111, 113, 128, 156, 173, 175, 194, 271, 349, 360, 381
Dolphin, 155, 156, 159
Doomsday scenario, 335, 341, 342
Doppler method, 290
Doppler shift, 255, 256, 257, 259, 260, 268, 277, 286, 313
Doyle, Laurance, 156
Dr. Strangelove, 369
Dragon's Egg, 28
Dragons of Eden, 189

Dolphin, 155, 156, 159
Doomsday scenario, 335, 341, 342
Doppler method, 290
Doppler shift, 255, 256, 257, 259, 260, 268, 277, 286, 313
Doyle, Laurance, 156
Dr. Strangelove, 369
Dragon's Egg, 28
Dragons of Eden, 189

Drake equation, 291, 344, 359
Druyan, Ann, v, 31, 35, 314
Duck Creek formation, 130
Dyson, Freeman, 7, 189, 350, 357
Earth

formation of life, 194
future of life, 11
habitability, 190
history of life, 125
impacts by asteroids, 222
moment of inertia, 115
nitrogen atmosphere, 220
oldest rocks, 84
oxygen atmosphere, 119
plate tectonics, 190
prebiotic, 63
snowball episode, 117
spectrum of, 299
tectonics, 108

Earth: Evolution of a Habitable World, 189
Ediacara era, 137
Edison, Thomas, 372
Enceladus, 193, 196, 201, 202
ensues on, 202
water on, 193

Encephalization ratio, 47, 344, 359
Encephalization ratio, 150, 159, 160, 161, 323
Enzyme, 20, 62, 63, 76, 111, 328
Epistemology, 343
Ethogram, 152
Eukaryote, 99, 131, 195
Europa

analog, 226
life on, 68, 109, 164, 180, 192, 218, 339
ocean, 218
Evolution, 129
and contingency, 307
and diversity, 76

bottleneck, 334, 335, 380
burst of, 116
chemical, 59
cosmic, 34
cultural, 379
Darwinian, 59, 140
eventual environmental influences on, 95
filter, 339, 340
human, 338
mass extinction, 67
molecular, 20
of brain size, 157, 158
of complexity, 129, 171
of eyes, 144, 383
of intelligence, 53, 132, 140, 142, 157, 159, 162, 323, 354, 357, 365
of life, 16
post-biological, 334, 343, 346, 359
rate of, 330, 339, 340
rate of, 330, 339, 340
rate of, 330, 339, 340
technological, 332, 333, 380
ExoMars spacecraft, 175
Exoplanet

47 Ursa Majoris, 259
51 Pegasus, 247, 259, 275, 286
55 Cancri, 261, 262
70 Virginis, 259, 260
architectures, 220
atmospheres, 133, 275, 280, 288, 295
biosignatures, 283
composition, 281, 287, 302
cores, 291
density, 279, 286
detecting Earths, 268
detection of, 7, 256, 259, 358
Dinky, 266

discovery of, 180, 189, 255
diversity, 290
Earth-like, 273, 277, 299, 349
eccentric orbits, 261, 269, 271
eclipses, 278, 286
first discovery of, 231, 246, 285
Fourpiter, 266
Gliese 876, 262
habitability, 190, 294
HD 149026, 262
HD 209458, 287, 288
hot Jupiters, 247, 250, 269, 275, 289
imaging, 275
incidence of, 191
Jupiter analogs, 261
life on moons of, 219
mass distribution, 269
microlensing, 277
multiple-planet systems, 266, 270
pulsar, 279
rocky cores, 262
size, 289
spectra, 299
super-Earths, 191, 260, 261, 276, 283, 295
super-Jupiters, 191, 219, 276, 290
survival in binary system, 272
temperature, 281
terrestrial, 268, 277, 291, 295
transiting, 276, 278, 279, 281, 287, 290
Two piter, 266
Upsilon Andromedae, 266, 267, 270
Experimental science, 248
Exponential change, 328
Extraterrestrial life
and popular culture, 38, 40, 186, 349
and religion, 227
belief in, 186
civilizations, 310, 334, 335, 339, 344, 359
colonization, 310, 325, 334, 339, 345
contact with, 227
evidence for, 51, 127
first discovery of, 196
history of idea, 23
impact of discovery, 10, 21, 173
in an infinite universe, 344
intelligent, 10, 307, 314, 318, 323, 375, 376
nature of, 380, 381
probability of, 338, 357, 384
sense of humor, 385
speculation about, 24
technology, 310, 323, 324, 325
the search for, 349
world view, 29
Extra-vehicular activity, 45
Extremophile, 64, 95, 96, 100, 180, 183, 358
Eye
convergent evolution of, 162
Fermi paradox. See Fermi question
Fermi question, 29, 53, 141, 310, 325, 333, 334, 335, 341, 344, 358, 359, 365
Ferris, Timothy, v, viii, 3, 6, 33
Fieldwork, 83, 95, 113, 124, 136, 148, 149, 153, 174, 175, 176
Fine-tuning arguments, 343, 344, 359
Fischer, Debra, vi, viii, 262, 264, 266
Focal animal sampling, 149
Forward, Robert, 28, 360
Fossils, 86, 100, 115, 124, 129, 133, 135, 136, 157, 212
atomic, 89, 126
body, 86
molecular, 88
trace, 87, 126
Foster, Jodie, 36, 37, 305, 314
Fractionation, 90
Frost, Robert, 6
Fry, Iris, v, viii, 13
Fundamentalism, 38
Future of Humanity Institute, 338
Gaia hypothesis, 66, 172, 180, 190
Galactic Quest, 369
Galilei, Galileo, 25, 180
Gamma ray burst, 311
Ganymede, 201
Geochemical cycling, 103
Geological mapping, 84
Goldilocks principle, 8, 341
Goldin, Daniel, 180
Goldreich, Peter, 198, 247, 248
Grand Tour of the Solar System, 369
Gravity
strength of, 359, 360
Grey goo scenario, 331
Grinspoon, David, vi, viii, 178
Index

Habitable zone, 65, 96, 180, 201, 219, 270, 273, 277, 294, 358
Haldane, J. B. S., 17, 18, 20
Hanlon, Roger, vi, viii, 143, 148
Hart, Michael, 325
Hawking, Stephen, 348
Hayden Planetarium, 50, 317, 366
Hecht, Jennifer Michael, vi, ix, 377
Hemoglobin, 139
Heraclitus, 38
High Frontier, 119
Historical science, 353
History of science, 33, 379
Homeobox genes, 117
Horowitz, Paul, 307, 309
Howard, Andrew, 310
Hoyle, Fred, 343, 352, 359
Hubble Space Telescope, 46, 287, 297
Human enhancement, 338, 346
Human Genome project, 328
Human Genome project, 328
Human morality, 380
Huygens, Christian, 54
Huygens probe, 192, 203, 229, 234
Hydrodynamics, 251
Hydrogen fluoride, 257, 267
Hydrothermal vent, 103, 104, 105, 108
Hypatia, 36, 37
Hypothetical biology, 360
Hypothetical universes, 359, 360
Ice
properties of, 60
If the Universe is Filled with Aliens, Where is Everybody?, 358
Inertial Interchange True Polar Wander, 115
Inflationary cosmology, 362, 364
Information technology, 322, 328, 330
Intelligent Life in the Universe, 6, 23, 318
Interferometer, 296
Interferometry, 318
International Space Station, 180, 371
Io, 182, 185
life on, 185
Iodine, 257, 267, 268
Isotopic ratio, 219
Issua rock formation, 86
Jane Goodall, 35
Joy, Bill, 327
Joyce, Gerald, 59
Jupiter
core, 291
life on, 77, 183
moons of, 218
Kant, Immanuel, 14, 22
Kasting, James, 189
Kauffman, Stuart, 182
Kepler, Johannes, 23, 25, 270
Kepler spacecraft, 30, 191, 291, 292
Kirschvink, Joe, v, viii, 112
Knoll, Andrew, v, viii, 94, 123, 130
Kubrick, Stanley, 369
Kurzweil, Ray, vi, viii, 326, 329
Lagerstätten, 135, 136
Lagrange points, 310
Lake Vostok, 226
Language, 164
Laplace, Pierre, 251
Last common ancestor, 194
Late Heavy Bombardment, 90
Late veneer, 219
Lateral gene transfer, 194
Latham, David, 287
Laughlin, Greg, 268
Laws of nature, 363
Laws of physics, 51
Lederberg, Joshua, 179
Leshin, Laurie, vi, viii, 207, 209
Leslie, John, 342
Levinson, Hal, 270
Lewis, John, 179, 218
Life
alternative forms, 174
and cosmic graininess, 360, 361
and disequilibrium, 360
and plate tectonics, 172
and thermodynamics, 195
camouflage, 144, 145, 147, 148, 151, 152
carbon-based, 72, 182
clay-based, 66
common ancestor, 107, 121
contingent evolution, 15, 21, 162
defining complexity, 99, 127
dependence on stars, 52
earliest evidence for, 86, 125
earliest organisms, 106
emergent phenomenon, 194
energy source, 65, 107
environmental influences, 101, 114, 129, 181
evolution of, 136
gene expression, 131
Index

Mayr, Ernst, 28
McCowan, Brenda, 156
McKay, Chris, vi, viii, 167, 179, 189, 234
McKay, David, 127
McMillan, Robert, 247
Meadows, Vikki, vi, viii, 293
Melosh, Jay, 350
Meridiani Planum, 236
Messenger, John, 143, 144
Metabolism, 76, 90, 107, 158, 184, 300
Metamorphism, 83, 125, 126
Metaphor
for life, 28
in film, 5
Meteorite, 208, 209
amino acids in, 211, 212
chemical composition, 210, 221
chondrite, 208
Ensiseime, 223
flux per year, 224
hunting in Antarctica, 224, 225
iron, 220, 224
Kabbah, 223
L'Aigle, 223
lunar, 225
Martian, 212
organic material, 210
primitive, 211
stony, 223, 224
Methane, 107, 281, 297, 301
Methanogen, 116, 297
Microbes
culturing in the lab, 99
survival in space, 351
Microbial community, 95
Microbiology, 94, 103
Microfossil, 126
Miller, Stanley, 18, 19, 20, 27, 59, 92, 130
Miller-Urey experiment, 19, 20, 27, 92
Molecular diversity, 73
Molecular machine, 338
Molecular system, 62
Monte Carlo code, 244
Moon
lack of water, 220
Moon, Mars, and Beyond
commission, 56, 193, 215
Moons
subsurface oceans, 201
Moore's law, 329
Morris, Simon Conway, v, viii, 134, 137, 307
Morrison, Philip, 11, 308, 310, 315, 317, 357
Multicellularity, 53, 91, 100, 131, 162, 195
Multiverse, 24, 343
Multiverse theory, 344, 362, 363, 364
Murmurs of Earth, 6, 7
Musgrave, Story, 44
Mutation, 132
Mysticism, 32
N-body calculation, 245
Nanobot, 330, 331, 332, 335
Nanotechnology, 328, 331, 335
NASA, 371
and descoping, 203
and human exploration, 215
and SETI funding, 307
astrobiology program, 168
astronaut program, 43
beauacracy, 169
budget history, 55, 297
Chief Historian, 22, 30
exobiology program, 27
follow the water, 68, 235
foundation of, 28
funding, 202
future missions, 205
Historical Reference
Collection, 30
missions, 172
road map, 307
secrets, 48
support of astrobiology, 28
support of SETI, 28, 306
NASA Astrobiology Institute, 81, 102, 155, 293, 295
National Academy of Sciences, 35, 307, 348
Natural selection, 132
Nebulaw lifetime, 210
Nelson, George, v, viii, 41, 46
Neptune
rings of, 199
Neutron star, 28, 360
New York Post, 53, 4
Newton, Isaac, 25, 52, 199, 244
Noyes, Bob, 285, 287
O'Neall, Gerard K., 119
Observational selection, 338, 343
Occam's razor, 343
Octopus, 53, 141, 143, 144, 145, 146, 148, 149, 150, 151, 152, 162, 381
Oliver, Barney, 306
Olympus Mons, 170
On the Origin of Species, 79, 81
Oparin, Alexander, 17, 18, 20
Orbital resonance, 270
Orgel, Leslie, 101
Origins of Life, 350
Oxygen, 297
Ozone, 108, 176, 238, 263, 281, 298, 299, 300, 301, 314

Pace, Norman, 72
Pale Blue Dot, 36
Paleocene era, 116
Paleomagnetics, 113, 115
Paleontology, 82, 117, 127, 135
Paleozoic era, 124
Panspermia, 16, 17, 100, 196, 350, 351, 352
Parrot, 161
Pasteur, Louis, 16, 17, 379
Pathfinder spacecraft, 9, 229, 232, 233, 234
Pathogen, 328
Payne, Roger, 7
Peel, Stanley, 244
Pepperberg, Irene, 161
Perchlorate, 238
Permian-Triassic boundary, 113
pH, 64, 96, 238
Pheomone, 161
Phosphorus, 220
Photosynthesis, 66, 95, 107, 171, 301, 302
Pioneer 11 spacecraft, 230
Pioneer Venus spacecraft, 230
Planet
definition of, 228
dynamism, 181
formation, 191, 244, 246, 249
geological activity, 182
habitability, 192
migration, 191, 247, 248, 250, 261, 271, 276, 279, 290

Planetary exploration, 200
Planetaryesimal, 210, 244, 272
Plato, 10
Plurality of Worlds, 23
Plurality of worlds idea, 23
Pluto Express spacecraft, 369
Poetry, 377, 378
Polar Lander spacecraft, 234
Polarization, 152
Pollack, James, 168, 179
Polycyclic aromatic hydrocarbons, 127
Polymerase Chain Reaction, 175
Porco, Carolyn, vi, vii, 37
Porcupine, 155
Post hoc fallacy, 8
Prebiotic chemistry, 78, 184, 201, 210, 215
Precambrian era, 131
Predeterminism, 352
Primordial soup, 18
Privatization of space, 169, 371, 375
Project OZMA, 306, 309, 312, 317
Prokaryote, 339
Protein structure, 67
Protobionte, 194
Protist, 94
Pulsar, 320
Pyrimidine, 77
Quasar, 320
Queloz, Didier, 247, 265
Quinn, Tom, 190
Quivering mixture, 211
Radial velocity, 254, 256, 267, 279, 283, 289
Radical astronomy, 312, 317
Radioactive isotopes, 209, 221
Raymond, Sean, 190
Rees, Martin, vi, vii, 350, 356, 357
Reference class, 341, 342, 343
Religion, 227
Return to Mars, 370
Reynolds number, 141
Ribose, 60, 65
Rio Tinto mine, 64
RNA, 20, 59, 60, 63, 66, 98, 101, 111, 194, 271
RNA World hypothesis, 59
Robotic intelligence, 332
Robots, 234, 327, 331
Rolling Stone, 3, 4, 6
Roosevelt, Eleanor, 37
Rothschild, Lynn, viii, 93
Russell, Maria Doria, 29
Russell, Michael, 73
Safronov, Victor, 244, 250
Salaroff, Ed, 183, 358
Saturn
moons of, 204
rings of, 198, 199, 204, 247
Schmidt, Otto, 244
Schrodinger, Edwin, 350, 357

© in this web service Cambridge University Press
www.cambridge.org
Index

406  Index

Science and popular culture, 369
apprenticeship, 256
experimental, 14, 85, 306
exponential growth of, 54
historical, 14
nature of, 198, 374
uncertainty in, 52
Science education, 34
Science fiction, ix, 25, 28, 29, 38, 48, 71, 72, 73, 179, 186, 218, 293, 347, 359, 360, 366, 367, 368, 369, 370, 375, 380
Science-fiction movies, 368
Scientific discovery, 198
Scientific method, 32, 34, 223
Scout program, 234
Seager, Sara, vi, viii, 274
Search for Extraterrestrial Intelligence, 306, See SETI
Second genesis, 349, 353
Seeing in the Dark, 3, 5
Selection effect, 341
Self-sampling assumption, 342
Serkowski, Kristof, 231
SETI, 133, 164, 186, 334, 349, 358
“wow” signal, 319, 320
and anthropocentrism, 313, 323
and anthropology, 30
and anthropomorphism, 11
and astrophysics, 320
and communication, 152
and cultural preference, 318
and Greenstein Report, 307
and intelligence, 11
and pulsed lasers, 322
archeology of the future, 310
astroengineering, 324
blind search, 310
first detection, 324
funding issues, 307, 313, 322
Golden Fleece Award, 306
optical, 11, 309, 321, 322
parameter space, 308, 309, 312, 322
probability of detection, 308
radio, 309, 317, 321
search strategy, 358
sensitivity, 312, 319
signal bandwidth, 309, 320
signal energy costs, 321
signal verification, 313, 319
signals, 309
Soviet scientists, 318
strategy, 29
targeted search, 309
targets, 312
transmitters, 323
Shadow biosphere, 353
Shklovsky, Ivan, 6, 23, 318
Shostak, Seth, vi, viii, 312, 316
Silane, 182
Silicon chemistry, 70
Simulation hypothesis, 2420, 324, 333, 345, 365
Singularity, 329, 334, 335
Smith, Peter, vi, viii, 229, 233, 235
Smith, William, 135
Snowball Earth, 115, 117, 118
Social insect, 161
Socrates, 12
Sodium, 67, 162, 280, 289
Solar Maximum spacecraft, 43
Solar nebula, 219
Solar power satellite, 371
Solar System
age of, 209, 221
dynamical state, 245, 269
formation of, 208, 211, 221
small bodies, 220
stable orbits, 245
water, 219
Solvent, 66, 72, 111
Sonninum, 25
Sonneborn, Tracy, 98
Soter, Steve, 34
Space
colonization of, 374
cost of missions, 205
elevator, 372, 373
habitat, 375
humans in, 46, 56, 216
missions, 230
our future in, 47
privatization of, 56
program, 27, 43, 47, 48, 54, 55, 173, 199, 216, 371
robots in, 46, 56
tourism, 47, 56
travel, 54
walk in, 43
Space exploration, 371
future of, 205, 375
human, 373
public support, 371
robotic, 373
<table>
<thead>
<tr>
<th>Term</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Interferometry Mission</td>
<td>295</td>
</tr>
<tr>
<td>Space Shuttle, 41, 43, 44, 45, 180, 371</td>
<td></td>
</tr>
<tr>
<td>Spatial dimensions number of, 364</td>
<td></td>
</tr>
<tr>
<td>Speed of light, 49, 310, 324, 334, 345, 375</td>
<td></td>
</tr>
<tr>
<td>Spirit and Opportunity Mars rovers, 196</td>
<td></td>
</tr>
<tr>
<td>Spirituality, 38, 186</td>
<td></td>
</tr>
<tr>
<td>Spitzer Space Telescope, 210, 277, 281, 291</td>
<td></td>
</tr>
<tr>
<td>Sputnik, 42, 218</td>
<td></td>
</tr>
<tr>
<td>Squyres, Steven, 68</td>
<td></td>
</tr>
<tr>
<td>Star Trek, 66, 369, 383</td>
<td></td>
</tr>
<tr>
<td>Steele, Duncan, 350</td>
<td></td>
</tr>
<tr>
<td>Stellar granulation, 260</td>
<td></td>
</tr>
<tr>
<td>Stevenson, David, 65</td>
<td></td>
</tr>
<tr>
<td>Stoker, Carol, 234</td>
<td></td>
</tr>
<tr>
<td>String theory, 364</td>
<td></td>
</tr>
<tr>
<td>Stromatolite, 87, 88, 89, 126, 302</td>
<td></td>
</tr>
<tr>
<td>Structure formation, 360, 361</td>
<td></td>
</tr>
<tr>
<td>Substrate independence, 346</td>
<td></td>
</tr>
<tr>
<td>Sulfur, 77, 89, 90, 107, 111, 126, 127, 185, 192, 238, 297, 301</td>
<td></td>
</tr>
<tr>
<td>Sulfur dioxide, 185</td>
<td></td>
</tr>
<tr>
<td>Sulfuric acid, 183</td>
<td></td>
</tr>
<tr>
<td>Sun-like stars, 191, 256, 258, 269, 277, 292, 298</td>
<td></td>
</tr>
<tr>
<td>Szostak, Jack, 59, 65</td>
<td></td>
</tr>
<tr>
<td>Tardigrade, 97, 98</td>
<td></td>
</tr>
<tr>
<td>Tarter, Jill, vi, viii, 36, 37, 305, 317</td>
<td></td>
</tr>
<tr>
<td>Taylor Valley, 174</td>
<td></td>
</tr>
<tr>
<td>TCA cycle, 108</td>
<td></td>
</tr>
<tr>
<td>Technological progress, 308</td>
<td></td>
</tr>
<tr>
<td>Technology, 327, 329, 338</td>
<td></td>
</tr>
<tr>
<td>Telluric lines, 267, 268</td>
<td></td>
</tr>
<tr>
<td>Terrestrial Planet Finder, 133, 193, 263, 272, 282, 283, 295, 296, 298</td>
<td></td>
</tr>
<tr>
<td>The Age of Spiritual Machines, 327</td>
<td></td>
</tr>
<tr>
<td>The Biological Universe, 23, 27, 29</td>
<td></td>
</tr>
<tr>
<td>The Cosmic Connection, 189</td>
<td></td>
</tr>
<tr>
<td>The Creation of the Universe, 3, 5, 10</td>
<td></td>
</tr>
<tr>
<td>The Emergence of Life on Earth, 13</td>
<td></td>
</tr>
<tr>
<td>The Evolution of the Protoplanetary Cloud and the Formation of the Earth and the Planets, 244</td>
<td></td>
</tr>
<tr>
<td>The New Yorker, 194</td>
<td></td>
</tr>
<tr>
<td>The Red Limit, 5</td>
<td></td>
</tr>
<tr>
<td>The Singularity is Near, 326, 330</td>
<td></td>
</tr>
<tr>
<td>The Sparrow, 29</td>
<td></td>
</tr>
<tr>
<td>The War of the Worlds, 28</td>
<td></td>
</tr>
<tr>
<td>Tholins, 231</td>
<td></td>
</tr>
<tr>
<td>Thomas, Lewis, 8</td>
<td></td>
</tr>
<tr>
<td>Time travel, 349</td>
<td></td>
</tr>
<tr>
<td>Timing argument, 164, 323, 325, 335, 341, 345</td>
<td></td>
</tr>
<tr>
<td>Titan, 231</td>
<td></td>
</tr>
<tr>
<td>atmosphere of, 231</td>
<td></td>
</tr>
<tr>
<td>future missions to, 205</td>
<td></td>
</tr>
<tr>
<td>landing on, 204</td>
<td></td>
</tr>
<tr>
<td>life on, 73, 77, 173, 184, 193</td>
<td></td>
</tr>
<tr>
<td>methane cycle, 184</td>
<td></td>
</tr>
<tr>
<td>methane on, 184, 297</td>
<td></td>
</tr>
<tr>
<td>surface of, 61, 193</td>
<td></td>
</tr>
<tr>
<td>Tomasko, Martin, 230</td>
<td></td>
</tr>
<tr>
<td>Transit method, 278, 286, 290</td>
<td></td>
</tr>
<tr>
<td>Tree of life, 20, 100, 105, 121, 129, 194, 353</td>
<td></td>
</tr>
<tr>
<td>Tremaine, Scott, 247, 248</td>
<td></td>
</tr>
<tr>
<td>Twain, Mark, 6, 372</td>
<td></td>
</tr>
<tr>
<td>Tyson, Neil deGrasse, v, viii, 50</td>
<td></td>
</tr>
<tr>
<td>UFOs, 29, 54, 186, 313, 317, 349, 350</td>
<td></td>
</tr>
<tr>
<td>Ultramasic rock, 109</td>
<td></td>
</tr>
<tr>
<td>Uniformity of nature, 25</td>
<td></td>
</tr>
<tr>
<td>Universal biochemistry, 72, 140, 359</td>
<td></td>
</tr>
<tr>
<td>Universe or Multiverse?, 363</td>
<td></td>
</tr>
<tr>
<td>Urey, Harold, 18, 19, 20, 27, 92, 189</td>
<td></td>
</tr>
<tr>
<td>Vatican Observatory, 221</td>
<td></td>
</tr>
<tr>
<td>Venera 13 spacecraft, 183</td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td></td>
</tr>
<tr>
<td>atmosphere of, 294</td>
<td></td>
</tr>
<tr>
<td>habitability, 192</td>
<td></td>
</tr>
<tr>
<td>life on, 111, 182</td>
<td></td>
</tr>
<tr>
<td>nitrogen in atmosphere, 220</td>
<td></td>
</tr>
<tr>
<td>surface of, 61, 183</td>
<td></td>
</tr>
<tr>
<td>Verne, Jules, 54</td>
<td></td>
</tr>
<tr>
<td>Victoria Crater, 128</td>
<td></td>
</tr>
<tr>
<td>Viking spacecraft, 8, 9, 26, 27, 94, 103, 104, 137, 138, 167, 219, 174, 175, 179, 208, 240, 203, 239</td>
<td></td>
</tr>
<tr>
<td>Virtual Planetary Laboratory, 293, 294, 295</td>
<td></td>
</tr>
<tr>
<td>Virtual reality, 49, 331, 332, 372</td>
<td></td>
</tr>
<tr>
<td>Vogt, Steve, 273</td>
<td></td>
</tr>
<tr>
<td>von Braun, Werner, 48</td>
<td></td>
</tr>
<tr>
<td>Von Neumann probes, 339, 345</td>
<td></td>
</tr>
<tr>
<td>Voyager record, 3, 6, 7</td>
<td></td>
</tr>
<tr>
<td>Voyager spacecraft, 3, 6, 7, 36, 197, 198, 199, 200, 203, 231</td>
<td></td>
</tr>
<tr>
<td>Ward, Peter, 172</td>
<td></td>
</tr>
<tr>
<td>Walker, James, 172</td>
<td></td>
</tr>
</tbody>
</table>
Index

408  Index

Water delivery by comets, 219
  phase diagram, 61
Webb, Stephen, 358
Wells, Martin, 144
Wetherill, George, 244
Whale, 155, 157
Whitington, Harry, 135, 138
Wired magazine, 327
Woese, Carl, 105, 106
Women in science, 200, 265, 314
Writing, 368, 378
X-Prize Competition, 47
ancient Greek, 23
anthropocentric, 33, 39, 359, 381, 382
Cartesian, 24
Newtonian, 25
pre-Copernican, 33
Wormhole, 349
Zeeman effect, 256
Zemekis, Robert, 36
Zero gravity, 44
Zircon crystal, 82, 115, 116
Zubrin, Robert, 374
Young Sun paradox, 172
Young, J. Z., 141
World view

© in this web service Cambridge University Press  www.cambridge.org