

## Index

- abduction, *see* inference to the best explanation
- acceptance of hypotheses, 24, 179, 236–238
- Achinstein, Peter, 100, 189–192, 211–216, 228
- action potential, 202
  - Hodgkin-Huxley model of, 203–204, 208–210, 228
- activities, 227
- Adams, John Couch, 75
- aether, 185, 195
- aims of science, 128, 179, 180, 242
  - institutional, 244
- alternative hypothesis, 148
- analytic statements, 34
- Anderson, Carl, 169, 192
- androcentrism, 251, 252
- anomaly, 57, 75, 77
- anti-realism, 48, 67
- “anything goes”, 87
- Arago, Françoise, 28, 75, 195
- argument from inductive risk, 233–240, 242
- Aristotelianism, 94, 96, 121
- Aristotle, 93, 217
  - on explanation, 199
- Avogadro’s number, 190
  
- Barnes, Eric, 219
- Batterman, Robert, 222n
- Bayes’s theorem, 106, 118–120, 124, 130
- Bayes, Rev. Thomas, 106
- Bayesianism, 111–134, 135, 164, 191n, 237
  - personalist, 114, 132
  
- behavioristic construal of statistical tests, 151–152, 156, 160, 238–239, 240
- Bernard, Claude, 210
- betting rate, 113
  - fair, 113, 117
- binomial distribution, 138, 147
- Birnbaum, Allan, 152
- Blackett, P.M.S., 170, 192
- Bohr, Niels, 58
- Brown, Ernest William, 80
- Brownian motion, 190
  
- calibration, 37
- Carnap, Rudolf, 43, 44, 132, 229n
- Cartwright, Nancy, 188, 256n
- catch-all hypothesis, 123, 126–128, 133
- chance-based odds, 117
- chaos, 219n
- Charles’ Law, 46
- Chevalier’s problem, 107, 134
- Churchman, C. West, 238, 240
- circularity
  - of appeal to paradigms, 60, 69
  - of Woodward’s manipulationist account, 226
  - vicious- vs. premise-, 173
- cloud chamber, 169n, 169
- coherence, 114, 120
- communism, 245
- conditionals, 16, 43
  - counterfactual, 224
- consilience of inductions, 80n
- content noun, 213
- conventions, 22–23

- Copernicus, Nicolaus, 93  
 correspondence rules, 42, 45, 50  
 corroboration, 19–20  
 counterinduction, 89–97  
 Cox, David, 132  
 Craver, Carl, 204, 209–210, 227  
 crisis (Kuhnian), 58  
 curare poisoning, 210–211, 225, 226
- D-N model, 199  
 Darden, Lindley, 227  
 Darwin, Charles, 90  
   evolutionary theory of, 67, 68, 217  
 demarcation of science from non-science,  
   20, 23  
 determinism, 219n, 219  
 devil's advocate, 85, 91, 99  
 Dirac, Paul, 168–169, 196  
 disinterestedness, 245  
 domain of discourse, 51  
 Douglas, Heather, 240–243  
 Dowe, Phil, 221n  
 Duhem's problem, *see* underdetermination,  
   problem of  
 Duhem, Pierre, 27–28, 30–33, 39, 190, 194,  
   199n, 237  
 Dutch book, 114n, 114
- Einstein, Albert, 20, 41, 59  
   dynamics of, 62  
 electromagnetism  
   Maxwell's theory of, 195  
 Elliott, Kevin, 243  
 empirical adequacy, 179  
 empirical basis, 24  
 empiricism, 168, 178, 191  
   constructive, 179–183  
   logical, 33, 39–44, 48, 55, 56, 62, 69, 71,  
   96, 105, 132, 178, 216, 229n, 229  
 epidemiological studies, 157, 163  
 epistemological anarchism, 84, 86–102  
 error  
   ability of test to reveal, 153, 156, 164  
   arguments from, 156  
   ruling out, 11–14, 37  
   type I vs. type II, 149, 235–236  
   error-statistical philosophy, 135, 153–166,  
   255, 256  
 evidence, 161, 191, 209  
   contextual account of, 246  
   Mayo's minimal principle for, 153  
   securing of, 256  
   statistical, 152  
 evolutionary biology, 57, 68  
 expectation value, 138, 142  
 experimentation, 39, 187  
   coherence of, 188  
   epistemology of, 37, 38  
 explanandum, 184, 200  
 explanans, 184, 200  
 explanation, 199–228  
   Achinstein's pragmatic theory, 211–216  
   asymptotic, 222n  
   causal, 209, 220–228  
   causal mechanical account, 221–222  
   causal, manipulationist account, 223–226  
   covering law model, 199–210, 215, 228  
   mechanistic, 226–228  
   ordered pair account, 213–214, 216  
   unificationist theories, 216–220  
 explanation sketch, 201, 205  
 explanatory models, 247  
 explanatory store, 218  
 extension (of predicate), 52
- fallibilism, 89  
 falsifiability, 20  
 falsificationism, 15–25, 26, 73–74, 77,  
   83, 89  
   dogmatic, 73  
   methodological, 73  
   naïve vs. sophisticated methodological,  
   74, 76, 89n  
 Faraday, Michael, 69  
 feminist critiques, 251–254  
 Feyerabend, Paul, 71, 84–102, 252  
 filling instructions, 218  
 Fine, Arthur, 198  
 Fisher, Ronald, 142, 144, 162  
 Fizeau, Hippolyte, 28  
 Fizeau-Foucault experiment, 28–30, 36

- formaldehyde as carcinogen, 157–163,  
 234–236
- fossils, 121–127
- Foucault, Léon, 28, 36
- Franklin, Allan, 37
- fraud, 245, 245n, 245
- free will, xiii
- frequentism, *see* probability, as relative  
 frequency
- Fresnel, Augustin Jean, 194
- Freudian psychoanalytic theory, 21
- Friedman, Michael, 216n
- function, 52n
- funding of science, 231–232  
 and bias, 240
- Galilei, Galileo, 92–97
- Glennan, Stuart, 227
- “good sense”, 32, 38, 64
- Grene, Marjorie, 249
- gun violence research, 232
- Hacking, Ian, 187–189, 192
- Hall, Asaph, 79
- Hanson, Norwood Russell, 61n, 77
- Harding, Sandra, 253
- Harper, William, 79
- Hartsock, Nancy, 253
- Heisenberg, Werner, 59
- Hempel, Carl, 199–202, 204, 216
- Hesse, Mary, 69
- heterosexism, 251
- Higgs boson, discovery of, 141, 143
- hole theory (Dirac), 168–169, 177, 186, 196
- Hooke, Robert, 13
- Hume, David, 221n
- Huygens, Christian, 13
- IID (independent and identically  
 distributed), 138, 147
- illocutionary  
 acts, 211  
 force, problem of, 212
- incommensurability, 61–63, 67, 68  
 methodological, 61  
 semantic, 62
- induction, 90  
 problem of, 5–14, 15, 26
- inductive-statistical model, 201
- inductivism, 15, 26, 83
- inertia, principle of, 95
- inference to the best explanation, 172–174,  
 183, 189, 193
- instrumentalism, xxi, 171
- Intemann, Kristen, 254
- intervention, 224–225
- Jeffrey, Richard, 237
- Kitcher, Philip, 216–219  
 knowledge, 249n
- Kuhn, Thomas, 55–70, 71, 73, 93n, 125, 195
- Lakatos, Imre, 57, 71–84, 184
- Large Hadron Collider, 141
- Laudan, Larry, 35, 175–178
- laws, 200, 204–206, 206n  
 of equivalence, 207
- Le Verrier, Urbain, 75–78
- Leplin, Jarrett, 184
- Levi, Isaac, 238, 240
- Lewis, Peter, 178
- linear hormonal model, 247–248
- Lister, Martin, 125
- Lloyd, Elisabeth, 99
- Longino, Helen, 246–251, 252–254
- Mach, Ernst, 190
- Machamer, Peter, 227
- MacIntyre, Alasdair, 249
- man-the-hunter approach, 252
- manipulation, 223, 224
- Marxist theory of history, 21
- Massimi, Michela, 189, 192
- Maxwell, Grover, 180
- Mayo, Deborah, 132, 151n, 153–166, 239,  
 255
- McMullin, Ernan, 198
- mechanism, *see* explanation, mechanistic
- Mendel, Gregor, 68
- Mercury, anomalous orbit of, 77
- Merton, Robert K., 243n, 244–246

- metaphysics, 41, 43, 197, 199n
- Mill's methods, *see* Mill, John Stuart, A  
*System of Logic*
- Mill, John Stuart, 87, 101  
*A System of Logic*, 101  
*On Liberty*, 97–99
- Millikan, Robert A., 169n
- models  
 adequacy of, 147  
 idealization in, 46–48, 137  
 in formal semantics, 54  
 in semantic view, 45–48  
 probability, 108
- modus tollens, 18, 23, 26
- Musgrave, Alan, 81
- natural interpretations, 95
- natural ontological attitude (NOA), 198
- natural philosophy, xiii
- Neoplatonism, 121
- Neurath, Otto, 55
- New Experimentalism, 186
- Newcomb, Simon, 77, 79
- Newton, Isaac  
 celestial mechanics of, 75, 76, 220  
 dynamics of, 62, 195  
 emission theory of light, 28, 30  
 laws of motion, 47  
 optical experiments, 8–11, 156  
 rules for study of natural philosophy, 90  
 theory of gravity, 69, 79, 217
- Neyman, Jerzy, 147, 151n, 162
- Neyman-Pearson tests, 146–151, 154n  
 power of, 149–150  
 significance level of, 149–150
- no miracles argument, 171, 175–177, 194  
 circularity of, 173–174
- nomoc expectability, 201, 206–207
- normal science, 56–57, 70
- norms of science (Merton), 243–246
- novel prediction, 79–82, 184  
 heuristic, 82, 184  
 temporal, 80
- null hypothesis, 142, 144, 146, 234  
 null distribution as model of, 142, 143, 147
- objectivity, 132, 243, 246, 248–249, 254  
 of scientific community, 250–251  
 strong, 253
- observability, 180–182, 191
- observation  
 theory-ladenness of, 62
- Occhialini, G.P.S., 170, 192
- Oppenheim, Paul, 201
- organized skepticism, 246
- Ostwald, Wilhelm, 190
- p*-value, 143n, 143–146, 159
- paradigm, 56–63, 64  
 as disciplinary matrix, 57, 63  
 as exemplar, 57, 66
- Parametrized Post-Newtonian (PPN)  
 framework, 165n
- paresis, 206
- Pascal, Blaise, 107
- Pashby, Thomas, 186, 196
- Pauli, Wolfgang, 59
- Pearson, Egon, 147, 151n
- Peirce, Charles S., 154n, 172n
- Perrin, Jean, 190–192
- pessimistic meta-induction, 177–178
- phylogenetics, 64–67, 68  
 molecular, 57, 66–67
- Pinnick, Cassandra, 253
- pluralism, 251–254, *see* proliferation
- Poincaré, Henri, 190, 194, 195
- Poisson, Siméon Denis, 194
- Popper, Karl, 15–25, 26, 36, 71, 72
- positivism, *see* empiricism, logical
- positron, 183  
 as experimental tool, 187, 189, 193n, 193  
 discovery of, 169–171, 192–193  
 prediction of, 168
- pragmatism, 154n
- predicate, 50
- prediction, 201, 204, 209
- primates as model organisms, 232–233
- probability  
 as degree of belief, 111–134  
 as relative frequency, 111, 135–166  
 axioms, 109  
 conditional, 119

- function, 109, 110, 119
- posterior, 119, 125, 126, 132
- prior, 119, 123, 126, 127
- theory, 105
- progress of science, 67
- proliferation, 90, 100
- Psillos, Stathis, 173, 184, 185
- Ptolemy, Claudius, 93
- Putnam, Hilary, 171, 177
  
- quantifier, 51
- quantum electrodynamics, 177, 196
- quantum mechanics, 59
  - “Old Quantum Theory”, 58–59
- Quine, W.V.O., 33
  
- Ramsey, Frank P., 116
- random variable, 107
- rational reconstruction, 83
- rationality, 83, 114, 128, 130
- realism
  - anti-, 167–168, 171, 191, 194
  - divide and conquer strategy, 185–186, 195
  - entity, 187–189,
  - epistemic structural, 194–196
  - experimental argument for, 189–192
  - ontic structural, 194, 197
  - scientific, 48, 167, 171–174, 184–186
- reduction sentences, 42, 43
- reference priors, 131
- Reichenbach, Hans, 136, 140
- relativity
  - general theory of, 20, 41, 78, 165
  - of motion, Galileo’s principle of, 96
  - special theory of, 168, 195
- research programs
  - hard core of, 74, 76, 79
  - methodology of scientific, 74–84
  - negative heuristic, 75, 76
  - positive heuristic, 75, 77, 79
  - progressive vs. degenerating, 78
  - protective belt of, 74, 76
- Resnik, David, 188
- Retraction Watch, 245n
  
- revolutionary science, *see* scientific revolutions
- Rudner, Richard, 236–238
  
- $\sigma$ , *see* standard deviation
- Salmon, Wesley, 25, 190, 221
- satisfaction, 51
- scientific progress, 82
- scientific revolutions, 57, 59–61, 63, 69, 194
  - as challenge to scientific realism, 174–178
- Scriven, Michael, 205
- security, *see* evidence, securing of
- selectionist model, 247–248
- semantics, 49
- sentence schema, 50
- severity, 154–157, 193
  - analysis, 160–163, 165
  - principle, 154, 160, 164
- sexism, 251
- size of statistical test, *see* Neyman-Pearson tests, significance level of
- Snyder, Laura, 99
- sociology of science, 243n
- soundness, 4
- stake, 113
- standard deviation, 138, 141, 142
- standpoint epistemology
  - feminist, 253–254
  - Marxist, 253
- Stanford, Kyle, 198
- statistical significance, 140–146, 159
  - observed, 143
- statistics, 37, 69
  - Bayesian, 131–132
- Steel, Daniel, 241
- Stein, Howard, 198
- Steno (Niels Stensen), 122–123
- structural unemployment, 222
- structure, 51
  - realism about, *see* realism, epistemic structural and ontic structural
- subjective Bayesianism, *see* Bayesianism, personalist
- success, 184
- sure-loss contract, 114–115, 120

- synthetic statements, 34, 44  
 systematics, 64  
 systematization, 218
- test statistic, 142
- theory structure  
   semantic view of, 45–48, 179  
   syntactic view of, 44, 48
- transformative criticism, 250
- underdetermination, 26–38, 73, 182–183,  
   189, 209, 248, 254  
   Kuhnian, 63  
   problem of, 32–33, 127n  
   Quine's thesis of, 34  
   thesis, 26
- understanding, 199, 212, 213
- unified science, 55
- uniformity of nature, principle of, 7
- universalism, 244
- updating by conditionalization, 120, 124,  
   130
- Uranus, anomalous orbit of, 75
- use novelty, *see* novel prediction, heuristic
- vagueness, 181
- validity, deductive, 4
- value-free ideal, 229, 246, 252, 254  
   as autonomy, 230, 233  
   as impartiality, 230, 255  
   as neutrality, 230, 255
- values, 63, 229–257  
   cognitive, 230n  
   constitutive, 246  
   contextual, 246  
   direct vs. indirect roles, 240–243  
   epistemic, 230, 241  
   intellectual, 73, 82
- van Fraassen, Bas, 179–183
- verification principle, 41–44
- Vienna circle, 40–41, 49, 50, 55
- Vulcan, 78
- wagers, 113
- wave theory of light, 13, 185, 194
- Weber, Marcel, 209n
- Whewell, William, 80n
- Williamson, Jon, 132
- Wilson, C.T.R., 169n
- woman-the-gatherer approach, 252
- Woodward, James, 220, 223–226
- Worrall, John, 184, 194
- wouralia, *see* curare poisoning
- Wray, K. Brad, 68