

Contents

The Abel Prize—The Missing Nobel in Mathematics?	1
Kim G. Helsvig	
1 Science Prizes in Historical Perspective	2
2 A National Icon	4
3 The Initiative	6
4 Mobilization	9
5 The Abel Prize “Working Group”	10
6 Scientific Legitimization and Support	12
7 Political Lobbying	14
8 Breakthrough	17
9 High Expectations	18
10 Nobel Level?	22
11 Conclusion—And the Need for Future Adjustments?	25
References	27
2008 John G. Thompson and Jacques Tits	
Some Reflections	31
John G. Thompson	
A Biography of Jacques Tits	35
Francis Buekenhout	
1 1930–1944	35
1.1 A Belgian Mathematician	35
1.2 Ancestors	36
1.3 Parents	36
1.4 Grandparents	37
1.5 Child Prodigy—Always Ahead of His Age and of His Time	38
1.6 Charles Nootens and Petit Jacques	39
2 1945–1949	40

2.1	At the Age of Fourteen, Tits Entered University	40
2.2	Jean-Claude Piret, a Friend for Life	41
2.3	Lectures of Libois in 1945–1946	42
2.4	Research	43
2.5	First Degree in 1948	43
2.6	Paris and Emil Artin	43
3	1950–1963	44
3.1	Docteur ès Sciences Mathématiques	44
3.2	To Heinz Hopf in Zürich in 1950, 1951, and 1953	44
3.3	Institute for Advanced Study, Princeton and H.C. Wang (1951–1952)	45
3.4	The Cremona Plane	45
3.5	The Thèse d’Agrégation (1955)	45
3.6	Memoir for the Prix Louis Empain (1955)	47
3.7	Prehistory of Buildings (1955–1961)	47
3.8	Birth of the General Theory of Coxeter Groups (1961)	47
3.9	Denied Access to the US from 1953 to 1963	48
3.10	International Congress of Mathematicians (1954–1994)	49
4	1964–1975	50
4.1	Professor at the Universität Bonn (1964–1974)	50
4.2	Buildings Coming of Age (1974)	50
4.3	Collège de France (1975)	50
5	1976–2000	50
5.1	Professor at the Collège de France (1973–2000)	50
5.2	No Pension in Belgium (1994)	51
6	2001–2012	52
6.1	The Book with Weiss	52
6.2	Editor of Mathematical Journals	52
7	Postscript	52

The Work of John Griggs Thompson: A Survey 55

Richard Lyons and Robert M. Guralnick		
1	Thompson’s Thesis, and Local Analysis	55
2	The Thompson J -Subgroup and Weak Closure Arguments	58
3	Groups of Odd Order Are Solvable	60
4	N -Groups and Minimal Simple Groups	64
5	The B -Conjecture and the Grand Conjecture	66
6	Factorizations, Quadratic Action, and Quadratic Pairs	68
7	The Ree Groups	70
8	The Finite Sporadic Simple Thompson Group Th , also Known as F_3	72
9	“Elementary” Group-Theoretic Results	73
10	The Inverse Galois Problem	74
11	The Genus of a Permutation Group	76
12	Representation Theory	77

13	Projective Planes	79
14	Cosets	79
15	Divisor Matrix	80
16	Other Work	80
	References	80
A Report on the Scientific Contributions of Jacques Tits		87
	Francis Buekenhout	
1	Introduction	87
2	The Projective Line	88
3	The Cremona Plane Made Invariant Under the Cremona Group	89
4	Lie Groups and the Riemann–Helmholtz–Lie Problem	89
5	Doubly Homogeneous Spaces, and Homogeneous and Isotropic Spaces	91
6	Geometric Interpretation of the Five Exceptional Simple Lie Groups and the Magic Square	92
7	A World of Incidence Geometries	92
8	Generalized Polygons	93
9	Moufang Polygons	93
10	General Theory of Coxeter Groups	94
11	Theory of Buildings: Birth 1961	94
12	Applications of Buildings	96
13	Affine Buildings	96
14	Diagram Geometries and Sporadic Groups	97
15	The Local Approach to Buildings	97
16	Free Constructions	97
17	Algebraic Groups	98
18	Kac–Moody Groups and Twin Buildings	98
19	Moufang Polygons: Thirty Years Later	98
	References	99
List of Publications for John Griggs Thompson		101
List of Publications for Jacques Tits		109
Curriculum Vitae for John Griggs Thompson		123
Curriculum Vitae for Jacques Tits		125
2009 Mikhail Gromov		
A Few Recollections		129
	Mikhail Gromov	
A Few Snapshots from the Work of Mikhail Gromov		139
	D. Burago, Y. Eliashberg, M. Bestvina, F. Forstnerič, L. Guth, A. Nabutovsky, A. Phillips, J. Roe, and A. Vershik	
1	Introduction. Conceptual Thinking (by Dima Burago)	140

2	Gromov’s Geometry (by Anatoly Vershik)	143
3	The Gromomorphism $SU \rightarrow US$ (by Tony Phillips)	148
4	The h -Principle (by Yasha Eliashberg)	149
	4.1 Holonomic Approximation	150
	4.2 Removal of Singularities	156
	4.3 Convex Integration	157
5	The Homotopy Principle in Complex Analysis (by Franc Forstnerič)	161
	5.1 The Oka–Grauert Principle	161
	5.2 Gromov’s Oka Principle	162
	5.3 From Elliptic Manifolds to Oka Manifolds and Oka Maps	164
6	Soft and Hard Symplectic Geometry (by Yasha Eliashberg)	165
	6.1 Gromov’s Alternative	166
	6.2 Proof of the Arnold Fixed Point Conjecture for the $2n$ -Torus	169
	6.3 Advent of Holomorphic Curves	170
	6.4 Flexible Side of Symplectic Geometry is Still Alive	180
7	The Waist Inequality in Gromov’s Work (by Larry Guth)	181
	7.1 Why is the Waist Inequality Hard?	182
	7.2 A Quick History of the Waist Inequality, Part 1	183
	7.3 Combinatorial Analogues of the Waist Inequality	184
	7.4 Topological Analogues of the Waist Inequality	185
	7.5 A Quick History of the Waist Inequality, Part 2	187
	7.6 Quantitative Topology	188
	7.7 Gromov’s Short Proof of the Waist Inequality	190
	7.8 Gromov’s Proof of Point Selection	193
8	Quantitative Topology and Quantitative Geometric Calculus of Variations (by Alex Nabutovsky)	196
	8.1 Quantitative Topology	196
	8.2 Quantitative Geometric Calculus of Variations	201
	8.3 Gromov’s Filling Technique	204
	8.4 Slicing Riemannian Manifolds	205
	8.5 Filling Riemannian Manifolds	207
9	Geometric Group Theory (by Mladen Bestvina)	208
	9.1 Groups of Polynomial Growth	208
	9.2 Gromov–Hausdorff Limits	210
	9.3 Groups as Metric Spaces and Quasi-isometries	212
	9.4 $CAT(-1)$ and $CAT(0)$ Spaces	212
	9.5 Hyperbolization of Polyhedra	213
	9.6 Hyperbolic Groups	214
	9.7 Isoperimetric Functions	215
	9.8 L_2 -Cohomology	216
	9.9 Random Groups	218
10	Gromov’s Work on Manifolds of Positive Scalar Curvature (by John Roe)	221

10.1	Introduction	221
10.2	Simply-Connected Compact Manifolds	222
10.3	Beyond Simple Connectivity	223
10.4	Macroscopic Dimension and K -Area	225
	References	227
	List of Publications for Mikhail Leonidovich Gromov	235
	Curriculum Vitae for Mikhail Leonidovich Gromov	245
	2010 John Torrence Tate	
	Autobiography	249
	John Tate	
	The Work of John Tate	259
	J.S. Milne	
	Notations	259
1	Hecke L -Series and the Cohomology of Number Fields	260
	1.1 Background	260
	1.2 Tate’s Thesis and the Local Constants	262
	1.3 The Cohomology of Number Fields	265
	1.4 The Cohomology of Profinite Groups	269
	1.5 Duality Theorems	270
	1.6 Expositions	273
2	Abelian Varieties and Curves	273
	2.1 The Riemann Hypothesis for Curves	273
	2.2 Heights on Abelian Varieties	274
	2.3 The Cohomology of Abelian Varieties	277
	2.4 Serre-Tate Liftings of Abelian Varieties	280
	2.5 Mumford-Tate Groups and the Mumford-Tate Conjecture	281
	2.6 Abelian Varieties over Finite Fields (Weil, Tate, Honda Theory)	283
	2.7 Good Reduction of Abelian Varieties	284
	2.8 CM Abelian Varieties and Hilbert’s Twelfth Problem	285
3	Rigid Analytic Spaces	286
	3.1 The Tate Curve	287
	3.2 Rigid Analytic Spaces	288
4	The Tate Conjecture	290
	4.1 Beginnings	291
	4.2 Statement of the Tate Conjecture	292
	4.3 Homomorphisms of Abelian Varieties	293
	4.4 Relation to the Conjectures of Birch and Swinnerton-Dyer	295
	4.5 Poles of Zeta Functions	296
	4.6 Relation to the Hodge Conjecture	298
5	Lubin-Tate Theory and Barsotti-Tate Group Schemes	299
	5.1 Formal Group Laws and Applications	299

5.2	Finite Flat Group Schemes	302
5.3	Barsotti-Tate Groups (p -Divisible Groups)	303
5.4	Hodge-Tate Decompositions	305
6	Elliptic Curves	306
6.1	Ranks of Elliptic Curves over Global Fields	306
6.2	Torsion Points on Elliptic Curves over \mathbb{Q}	307
6.3	Explicit Formulas and Algorithms	307
6.4	Analogues at p of the Conjecture of Birch and Swinnerton-Dyer	308
6.5	Jacobians of Curves of Genus One	309
6.6	Expositions	310
7	The K -Theory of Number Fields	310
7.1	K -Groups and Symbols	310
7.2	The Group K_2F for F a Global Field	312
7.3	The Milnor K -Groups	314
7.4	Other Results on K_2F	315
8	The Stark Conjectures	315
9	Noncommutative Ring Theory	319
9.1	Regular Algebras	319
9.2	Quantum Groups	321
9.3	Sklyanin Algebras	321
10	Miscellaneous Articles	322
	Appendix Bibliography of Tate's Articles	328
	References	334
	List of Publications for John Torrence Tate	341
	Curriculum Vitae for John Torrence Tate Jr.	349
	2011 John W. Milnor	
	Autobiography	353
	John Milnor	
	Milnor's Work in Algebra and Its Ramifications	361
	Hyman Bass	
1	Introduction	361
2	Hopf Algebras	362
3	Growth of Groups	363
4	The Congruence Subgroup Problem	364
5	Algebraic K-Theory and Quadratic Forms	368
	References	372
	John Milnor's Work in Dynamics	375
	Mikhail Lyubich	
1	Preface	375
2	Selected Themes	376

2.1	Kneading Theory	376
2.2	Milnor’s Attractors	377
2.3	Self-similarity and Hairiness of the Mandelbrot Set	379
2.4	Beyond the Quadratic Family	381
2.5	Two-Dimensional Dynamics	385
2.6	Art Gallery	388
	References	389
John W. Milnor’s Work on the Classification of Differentiable Manifolds		393
L.C. Siebenmann		
1	Some Preliminaries	393
2	The Discovery of Exotic 7-Spheres	395
2.1	Synopsis	395
2.2	1956: Why the Surprise? Some History	396
2.3	Milnor’s Incendiary 1956 Article Appears	398
2.4	From Thom’s Cobordism to Diffeomorphism?	398
2.5	Milnor’s Test Manifolds	399
2.6	Towards an Easy ‘Endoscopic’ Classification of these 8-Manifolds	400
2.7	Towards a Classification of the 7-Manifolds $M(a, b)$	401
2.8	Milnor’s $SO(4)$ Bundle Notations	402
2.9	The First Pontrjagin Class	403
2.10	Exotic Homotopy 7-Spheres Appear	406
2.11	Milnor’s Invariant λ and Its Refinement μ	407
2.12	Weak Equivalences Among the $SO(4)$ Disk Bundles	409
2.13	Twisted Spheres Appear	411
2.14	Conjecturally Nonsmoothable Manifolds Appear	412
2.15	Comments on Motivation and Strategy	413
2.16	Smale’s Dramatic Explanation of Milnor’s ‘deus ex machina’	414
3	The Early Achievements of Surgery	415
3.1	A Rough Description of Surgery	415
3.2	The Springtime of Surgery	416
3.3	The First Flowering of Surgery	417
3.4	An Exact Sequence Entrapping Θ_n , for $n \geq 5$	420
3.5	Analysis of the Subgroup bP of Θ_n	421
3.6	Complements Concerning Boundaries of Parallelizable Manifolds	423
4	A Metamorphosis	425
4.1	Milnor’s Microbundles	425
4.2	Surgery for Classical Smooth Manifolds	426
4.3	Further Extensions of Surgery	426
4.4	Conjectures	427
	References	427
List of Publications for John Willard Milnor		435

Curriculum Vitae for John Willard Milnor	447
2012 Endre Szemerédi	
Autobiography	451
Endre Szemerédi	
The Mathematics of Endre Szemerédi	459
W.T. Gowers	
1 Introduction	459
2 Szemerédi's Theorem	460
2.1 Sketch Proof of Szemerédi's Theorem when $k = 3$	461
2.2 What Happens when the Progressions Are Longer?	463
3 Szemerédi's Regularity Lemma	464
3.1 Quasirandom Graphs and the Counting Lemma	465
3.2 Statement of the Regularity Lemma	465
3.3 Sketch Proof of the Regularity Lemma	466
3.4 The Regularity Lemma and Szemerédi's Theorem	468
4 The Triangle Removal Lemma	470
4.1 Sketch Proof of the Triangle Removal Lemma	470
4.2 Applications of the Triangle Removal Lemma	471
5 A Sharp Upper Bound for the Ramsey Number $R(3, k)$	473
5.1 Choosing an Independent Set More Carefully	474
6 A Counterexample to Heilbronn's Triangle Conjecture	477
7 An Optimal Parallel Sorting Network	480
8 A Theorem on Point-Line Incidences	484
8.1 Székely's Proof of the Szemerédi–Trotter Theorem	485
8.2 An Application of the Szemerédi–Trotter Theorem	486
8.3 What Are the Extremal Sets in the Szemerédi–Trotter Theorem?	487
9 The Probability that a Random ± 1 Matrix is Singular	487
9.1 The Need to Consider Dependences	488
9.2 The Main Idea	490
9.3 Subsequent Improvements	491
10 Conclusion	491
References	492
List of Publications for Endre Szemerédi	495
Curriculum Vitae for Endre Szemerédi	507
A Letter from Niels Henrik Abel to August Leopold Crelle	
Abel and the Theory of Algebraic Equations	517
Christian Skau	
1 Historical Context	517
2 Correspondence with Legendre	519

3	The Addition Theorem	520
4	Algebraic Equations—Primitive Elements	522
5	Irreducibility Principle	525
6	The Galois Group	526
7	The Fundamental Theorem and Solvability Criterion	529
8	Elliptic Functions and Algebraic Equations	530
9	Transformation Theory and Teilungsgleichungen	532
10	Posthumous Article	536
11	Kronecker’s Reaction	541
12	Galois’ Legacy	546
13	Twists of Fate—Poetic Justice	547
14	The Abel–Galois Linkage	548
	References	550
	The Abel Committee	553
	The Niels Henrik Abel Board	555
	The Abel Lectures 2003–2012	557
	The Abel Laureate Presenters 2003–2012	561
	The Interviews with the Abel Laureates	563
	Addenda, Errata, and Updates	565
	2003 Jean-Pierre Serre	565
	2004 Sir Michael Atiyah and Isadore M. Singer	566
	2005 Peter D. Lax	568
	2006 Lennart Carleson	569
	2007 S.R. Srinivasa Varadhan	570



<http://www.springer.com/978-3-642-39448-5>

The Abel Prize 2008-2012

Holden, H.; Piene, R. (Eds.)

2014, XVII, 571 p., Hardcover

ISBN: 978-3-642-39448-5