Contents

Preface .............................................................................................................................................. xi

Abbreviations for works of Hermann Grassmann ................................................................. xvii

On the lives of the Grassmann brothers ................................................................. 1

Description of the life of Hermann Grassmann by his son Justus Grassmann, probably written shortly after the death of his father, 1877 ................................................................. 3

Life history of Robert Grassmann, written by himself (1890) ........................................ 9

Historical contexts of Hermann Grassmann’s creativity ............... 17

Discovering Robert Grassmann (1815–1901) ................................................................. 19
  Ivor Grattan-Guinness

Hermann Grassmann’s theory of religion and faith ............................................... 37
  Johann Ev. Hafner

The Significance of Naturphilosophie for Justus and Hermann Grassmann .................. 49
  Marie-Luise Heuser

Justus and Hermann Grassmann: philosophy and mathematics .................. 61
  Michael Otte
Institutional development of science in Stettin in the first half 
of the nineteenth century in the time of Hermann Grassmann .................. 71 
Maciej Szukala

Philosophical and methodological aspects of the work 
of the Grassmann brothers ................................................. 85

Brief outline of a history of the genetic 
method in the development of the deductive sciences ......................... 87 
Lyubov Gavrilovna Birjukova

Grassmann’s epistemology: multiplication and constructivism ............... 91 
Paola Cantú

Axiomatics and self-reference
Reflections about Hermann Grassmann’s contribution 
to axiomatics .................................................................. 101 
Mircea Radu

Concepts and contrasts: Hermann Grassmann and Bernard 
Bolzano ............................................................................. 117 
Steve Russ

Diversity of the influence of the Grassmann brothers .......................129

New forms of science and new sciences of form: On the 
non-mathematical reception of Grassmann’s work .............................. 131 
Paul Ziche

Some philosophical influences of the Ausdehnungslehre ...................... 141 
Albert C. Lewis

Grassmann’s influence on Husserl .............................................. 149 
Mirja Hartimo

Ernst Abbe’s reception of Grassmann in the light 
of Grassmann’s reception of Schleiermacher ................................. 161 
Hans-Joachim Petsche
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the early appraisals in Russia of H. and R. Grassmann’s achievements</td>
<td>175</td>
</tr>
<tr>
<td>Boris Biryukov and Zinaida Kuzicheva</td>
<td></td>
</tr>
<tr>
<td>Hermann Grassmann’s Work and the Peano School</td>
<td>185</td>
</tr>
<tr>
<td>Paolo Freguglia</td>
<td></td>
</tr>
<tr>
<td>Did Gibbs influence Peano’s “Calcolo geometrico secondo l’Ausdehnungslehre di H. Grassmann...”?</td>
<td>197</td>
</tr>
<tr>
<td>Filippo Demonte-Barbera</td>
<td></td>
</tr>
<tr>
<td>Rudolf Mehmke, an outstanding propagator of Grassmann’s vector calculus</td>
<td>209</td>
</tr>
<tr>
<td>Karin Reich</td>
<td></td>
</tr>
<tr>
<td>Robert and Hermann Grassmann’s influence on the history of formal logic</td>
<td>221</td>
</tr>
<tr>
<td>Volker Peckhaus</td>
<td></td>
</tr>
<tr>
<td>Hermann Grassmann’s contribution to Whitehead’s foundations of logic and mathematics</td>
<td>229</td>
</tr>
<tr>
<td>Jacques Riebe</td>
<td></td>
</tr>
<tr>
<td>Present and future of Hermann Grassmann’s ideas in mathematics</td>
<td>241</td>
</tr>
<tr>
<td>Grassmann’s legacy</td>
<td>243</td>
</tr>
<tr>
<td>David Hestenes</td>
<td></td>
</tr>
<tr>
<td>On Grassmann’s regressive product</td>
<td>261</td>
</tr>
<tr>
<td>Henry Crapo</td>
<td></td>
</tr>
<tr>
<td>Projective geometric theorem proving with Grassmann-Cayley algebra</td>
<td>275</td>
</tr>
<tr>
<td>Hongbo Li</td>
<td></td>
</tr>
<tr>
<td>Grassmann, geometry and mechanics</td>
<td>287</td>
</tr>
<tr>
<td>John Browne</td>
<td></td>
</tr>
</tbody>
</table>
Representations of spinor groups using Grassmann exterior algebra

Nikolay Marchuk

Hermann Grassmann’s theory of linear transformations

Jörg Liesen

The Golden Gemini Spiral

A. Swimmer

A short note on Grassmann manifolds with a view to noncommutative geometry

Jochen Pfalzgraf

Present and future of Hermann Grassmann’s ideas in philology

Hermann Grassmann: his contributions to historical linguistics and speech acoustics

John J. Ohala

Grassmann’s “Wörterbuch des Rig Veda” (Dictionary of Rig-Veda): a milestone in the study of Vedic Sanskrit

Maria Kozianka

The Rigveda Dictionary from a modern viewpoint

Toshibumi Goto

Grassmann’s contribution to lexicography and the living-on of his ideas in the Salzburg Dictionary to the Rig-Veda

Thomas Krisch, Christina Katsikadeli, and Stefan Niederreiter

Hermann Grassmann’s impact on music, computing and education

Calculation and emotion: Hermann Grassmann and Gustav Jacobsthal’s musicology

Peter Sühring
Classification of complex musical structures by Grassmann schemes ......................................................... 401
Guerino Mazzola

New views of crystal symmetry guided by profound admiration of the extraordinary works of Grassmann and Clifford ..................................................... 413
Eckhard Hitzer

From Grassmann’s vision to geometric algebra computing......................................................... 423
Dietmar Hildenbrand

Grassmann, Pauli, Dirac: special relativity in the schoolroom ..................................................... 435
Martin Erik Horn

Appendix ........................................................................................................................................ 453

On the concept and extent of pure theory of number (1827) ..................................................... 455
Justus Günther Grassmann (transl. by Lloyd Kannenberg)

Remarks on illustrations............................................................................................................... 489

Notes on contributors................................................................................................................ 505

References ................................................................................................................................... 525

Index of names and citations .................................................................................................. 553
The Rigveda Dictionary from a modern viewpoint

Toshifumi Gotô

The *Dictionary of the Rigveda* by Hermann Grassmann is the only standard Rigveda [RV] dictionary today.¹ The 5th reprint followed in 1976, and there exists a 6th edition, revised and supplemented by M. Kozianka [H. Grassmann 1996]. After its appearance, research has developed radically in the fields of philology (understanding of vocabulary and meaning) and grammar. The progress achieved in Indo-European linguistics in the twentieth century has been remarkable. The study of morphology including the functional analysis of grammatical forms has developed towards totally new dimensions. The *Dictionary*, nevertheless, is an essential tool even today. Its layout plays an important role in this regard. It seems that Grassmann could anticipate how the gaps should be bridged in the future, and how an entry would be more or less mechanically reinterpreted. I would like to report how this phenomenon was possible, foremost from my own three-year experience with the new translation of the Rigveda [Witzel and Gotô 2007], after the translations of Grassmann [RV1; RV2], [Ludwig 1876–1888], and [Geldner 1951] (completed in the 1920s, but published in 1951).


Lemmas, forms and meaning

The Rgveda is a collection of more than 10,000 ṛc-s “praising stanzas”, codified as a sacred text (veda) presumably about 1,200 B.C. It is not only the oldest text in India, but also one of the most important documents written in the Indo-European languages. Grassmann’s dictionary is an indispensable tool for RV scholars and for Indo-European studies in general.

Grassmann records all forms in the RV with almost all the occurrences and essential contexts. The occurrence is cited, however, inconveniently according to 2-figure numbers (sequential hymn and stanza), and not by the 3-figure numbers (book, hymn, and stanza) which are common today. The 1st edition of the RV by [Aufrecht 1861; 1863], which Grassmann used as a basis, gives us also the continuous numbering besides the 3-figure system. Unfortunately, in today’s standard edition [Aufrecht 1877] the collateral data has been left out. The songs have been classified and codified according to the poets’ families; within a family book, the number of the songs and stanzas as well as the length of the metrical line was standard for the arrangement of the songs. All these facts became obvious in full detail only after Grassmann’s Dictionary had appeared, through investigations by [Bergaigne 1886; 1887] and [Oldenberg 1888]. But Grassmann had already essentially recognized this arrangement. He writes about this editorial principle in his translation of the RV [RV1, 2]. His translation consists of two parts, reflecting his understanding of the editorial background as well: 1. “The family books of the Rig-Veda”; II–VIII [RV1], 2. “Collected books”: I, IX, X [RV2]. The information showing in which of the ten books a certain word form is attested is important. It is true that the 3-figure parameter causes substantially more difficulty for presentation and correction. Did the mathematician Grassmann confuse the philologist Grassmann here? Anyway, one cannot easily understand his decision. Maybe he had noticed the importance of this fact only gradually, during his translation, and did not have enough time for the rearrangement.

At first, let a group of verbal roots be taken up to illustrate Grassmann’s treatment, and to compare them with today’s state of research (“xxx” suggests omission; “583,10 [VII 67,10]” means: 583,10 in the Dictionary corresponds to Book 7, 67th Hymn, Stanza 10; this reference is omitted in Book 1; [] is my addition):

| 3jar, originally *gvar, substantially identical with jür, perhaps also with jvar (“be in fever”). Basic meaning: “grind down, wear out, consume” (cf. Kuhn, in his Zeitschrift für Vergleichende Sprachforschung…, Curtius, Grundzüge der griechischen Etymologie, 1866). (1) “grind down, make fragile, make old”; (2) “let become old”, i.e. “let reach an old age”; (3) “become fragile, become old, be consumed”; (4) “be ground down”; (5) causative “grind out, wear out, make old”. |
stem Jāra-: -anti (1) nāvām ∼ sarādas 465.7 [VI 24.7]. -atam (2nd person dual imperative) (2) sūrīn 583.10 [VII 67.10].

Jara-: -anta (3) pūrvās uṣasās 857.7 [X 31.7].
aorist Jāris-: -sus (3) mā dyummnāi 139.8.

stem of causative Jāraya-, Jāraya- see under participle.


participle of causative Jārayat- (Padāpāṭha jārayat-): -anti 124.10 (uṣās).

column 493

Juar, another form of Jara; (1) “become fragile, become old”, of living beings, further (2) of the god’s deeds; (3) “make frail, make old”; especially (4) participle II jūnā- “friable, brittle” (of a net 180,5). “frail” (of the casted-off snake’s skin 798,44 [IX 86,44]); (5) jūnā “very old”, without nuance of fragility. – Cf. Jūrv and Ni-jūr-.

stem I. Jūrā-: -atam (2nd dual imperative) paṇēs āsūm 182.3.

stem II. Jūrya-: -ati (1) sā (agnīs) ayā kṛpā nā ∼ 128.2. -anti (2) nā vām ∼ pūrvā kṛtāni 117.4.

imperfect Ajūrya-: -an (1) devanidas ha prathamās ∼ 152.2. participle Jūrat- (stem I): -atē (1) cyāvānāya 584.6 [VII 68.6]. -atām (1) 225.10 [II 34.10] (Jāraya).

Jūraya- (stem II) (see a Jūraya): atsu (1) vāneṣu (metaphorical) 257,1 [III 23.1], opposed to Ajūras (agnīs). -antai (dative feminine) (1) pātim ∼ adatta 117.7. participle perfect Jujūravās-, weak Jujūrūs-: (1) xxx participle II Jūrnā-: xxx (4) xxx. xxx (5) xxx. xxx (4) xxx. xxx (5) xxx. verbal Jūr-, “becoming old, aged”, included in a-, rta-, dhiyā-, saṅa-jūr-.

column 499

Jūrv, basic meaning presumably “wear out, consume”, and therefore related to Juar, and came from this (cf. Ni:jūr-); but limited in consuming by heat (of fire, lightening, sun), thus: “scorch, consume through the heat (of the sun)”. With Ni, “burn down, consume through the heat (of the fire, lightening)”. Sām, “burn, consume through the heat (of the fire)”.

stem Jūrva-: -asī sam 669.7 [VIII 60.7] atasām. -ati ni 1013.3 [X 187.3] rākṣānsi. -aḥas ni: rākṣas 620.4 [VII 104.4]. -ās ni: śatrūn 221.5 [II 30.5]. stem Jūrvav-: -a ni: spṛdhas 447.6 [VI 6.6].
aorist Jūrvī-: -it ni: āmānuśam 202.10 [II 11.10].

participle Jūrvavat-: -an (read Jūrvan) viśvāni 191.9. – ni 303.11[IV 7.11].

Note: The more basic form Jūr is found in Ni-jūr- “scorching, consuming.”