

# A Hundred Years Make No Small Difference: Popularization of Science in Hungary at the Turn of Two Centuries: Győző Zemplén's Conventionalism and Modern Fundamentalists<sup>1</sup>

GÁBOR Á. ZEMPLÉN

*Budapest University of Technology and Economics, Dept. for Philosophy and History of Science. Stoczek u. 2-4. St. fsz. 1. Budapest H-1111, Hungary. email: Zemplen@filozofia.bme.hu*

**ABSTRACT.** The development of physics, the focus of scientific debates, the institutionalization of science and science education in Hungary (admittedly on the peripheries of Europe) significantly differed from that of the most advanced parts of the continent (M. Zemplén, 1961, 1964, 1998). One might say that this process continues even today, as the Hungarian Academy of Sciences plays an unusually powerful (and conservative as well as conserving) role, and as the notion that each field has to have its national expert is still generally accepted, to name just a few of the several factors playing a role in the process. The article investigates whether these symptoms also characterise the popularization of science in Hungary or not.

After a cursory overview of popularization of science in Hungary and the history of science writing, I will compare works from the turn of the 20<sup>th</sup> and 21<sup>st</sup> centuries. The selection is naturally not comprehensive: only a few examples are discussed in detail. I will argue that a hundred years ago, Hungarian scientists writing for the general public could communicate both the most up-to-date scientific developments and new ideas in philosophy of science, while in the recent years popularization of science has taken a rather fundamentalist turn in Hungary.

The paper contributes, on the one hand, to the appreciation Győző Zemplén's work, on the other, it gives a critique of present-day popularization of science in Hungary, thus touching on recent debates on the role of popularization of science.

## 1. Popularization of Science and History of Science in Hungary

### 1.1 GENERAL REMARKS ON POPULARIZATION

Popularization of science in Hungary during the first half of the nineteenth century was closely connected to reform movements, aiming at establishing a vocabulary in Hungarian for all fields of inquiry. Thus it was primarily not aimed at legitimating the scientific enterprise as such (as can be seen in a number of eighteenth century European works – a tradition still visible today), but rather to narrow the developmental gap between Western Europe (“center”) and the periphery, and to create – if necessary “artificially” – a Hungarian scientific community and readership in Hungarian<sup>2</sup>. As Márton Varga still wrote in his 1819 *Science of Wonderful Nature* (Gyönyörű Természet Tudománya): “The embellishment, fame, profit of my nation, promoting religion, and improving the morals were my main urges not to write in Latin (which would have been less troublesome), but in Hungarian. I have shown that our mother tongue can carry *Philosophia*, and that using it it is possible to write about physics at the level of Latin school-books... This road, as all know, has not been travelled before” (Simonyi, 2000, 30)<sup>3</sup>.

The popularization of science was and is seen as part of a greater political agenda, promoting the development of the nation-state (or linguistic community) and has throughout (with some exceptions) positive connotations (and its opponents are often seen as enemies of development and prosperity). As Ferenc Pulszky in an 1891 speech summarised the role of the Academy, in its first phase, it “worked mostly on enriching our vocabulary, establishing the rules of Hungarian eloquence and the polishing of the literary language”. In its second phase, “the Academy concentrated on cultivating scientific approaches, not being content with acquainting the readers with translations on foreign research, but also collecting data and furthering science

in its own efforts; having reached the level of science in cultured nations, and thus being respected abroad” (Vekerdi, 1996, 125-6). While Pulszky’s view that by the 1890’s Hungarian science has reached a third phase and, as he originally wrote in the manuscript of his speech “is aiming at bringing the fruits of science (to which our own efforts have also contributed) to all the educated (so that science be popularized)” is surely illusory, and it clearly marks the importance of the popularization of science.

The second half of the nineteenth century with the founding of new schools, societies (Németh, 1998, 7-42), and new journals, like the *Természettudományi Közlöny* (Communications in the Natural Sciences) established in 1869 and still running, contributed to an unprecedented growth. Scientific research and popularization remained closely connected, partly as a result of the underdeveloped higher educational system. Most researchers receiving support for their studies were teachers in academic high-schools, as the number of universities remained very low.

## 1.2 REMARKS ON THE HISTORY OF SCIENCE WRITING

The popularization of science and the nation-preserving and furthering goals both contribute to the special status of the history of science in Hungary. Even today it is seen as a means of popularizing science and scientific understanding (and its legitimation as a discipline in its own right is still being questioned). This, while not an unknown aim, is by far not seen as the *major* task of the discipline in most European countries.

An example can highlight the differences, and show how differently Hungarian actors are presented to the general public. While great national scientific heroes have mostly become anti-heroes, and icons at times representing negative values (as Locke, Bacon, and Newton represented the Unholy Trinity for William Blake, etc.), this anti-science sentiment and rejection of scientific attitudes has not characterised the Hungarian scene. Here, the Romantic Movement was not characterised by the critical attitude typical of German or English romantics<sup>4</sup>. Similarly, the creation of the atomic bomb (where Hungarian scientists played no insignificant role) is generally seen as a sign of the level of Hungarian intellectual training between the World Wars. The tenability of the image of Hungarian “scientist-heroes” has also received much less criticism and attention as their counterparts in the “center”.

Most historians of science see their work as part and parcel of the popularization of science in Hungary: writing portraits of great men, enumerating Hungarian-born Nobel-prize winners (often including ones, like Elie Wiesel or John Charles Polanyi, who have never lived or were educated in Hungary (Nagy, 1995)), or exploring the “cultural history” of science – the general cultural background of a given epoch without implying that external factors would play a constitutive role in the development of science. In a number of cases a novel (and less cajoling) reading receives no little resistance from promoters of the received view: an example is the interpretation of Bolyai is Imre Tóth and János Tanács, both embedding the discovery of non-Euclidean geometries into a greater framework of scientific concept-building (Tanács, 2001). In an article on Bolyai, László Vekerdi notes how Hungarian history of science writing lags generations behind that of the center, sometimes not responding to whole trends.

My approach on the surface might seem to belong to the above mentioned tradition, as I will investigate the works of one of the early-twentieth century scientific icons, Győző Zemplén by drawing attention to his views on the philosophy of science. I do this, however, in order to contrast his solution to the problem of popularization of science with that of contemporary writers.

## 2. The Scientific Scene at the Turn of the 20<sup>th</sup> Century, and the Works of Győző Zemplén.

The peculiarities mentioned in the previous section need to be taken into account when the popularization of science in Hungary is investigated. The developments at the end of the nineteenth century resulted in a generation of scientists whose knowledge and training surpassed all previous generations. Important factors were reforms in secondary education and the increasing importance of natural sciences in the curricula, as well as the rapidly growing number of students in sciences and engineering (earlier the majority of students were trained at faculties of law). New universities and departments were established – some sponsored by the growing and strengthening industry. Special training colleges were created – probably the most famous being the József Eötvös College (founded in 1895), furthering the training of highly qualified teachers, and modelled on the *École Normale Supérieure* (Nemes, 1989).

Győző Zemplén (1879-1916) was a student of the Eötvös College<sup>5</sup>, and soon became one of the favourites of its founders, Loránd Eötvös. Eötvös, himself a student of Kirchhoff, Helmholtz, and Bunsen was a pre-eminent experimental physicist in Hungary (for a short biography see M. Zemplén & Egyed, 1970). His mentor's support allowed Zemplén to travel to Göttingen and Paris. Professor by the age of 26, soon becoming head of department, and member of the Hungarian Academy of Sciences in 1911, he achieved everything that a young researcher possibly could, even before his sudden death during World War I in 1916 (Kovács, 1975).

Apart from his main research interest in the inner friction of gases (for a bibliography of works see Abonyi, 1981; Balogh, Grédics, & Kovács 1979) he became a pioneer in communicating the latest developments of physics to the Hungarian readers. He was the first to teach statistical mechanics at a Budapest university, and introduced Maxwell's electrodynamics. His work as a popularizer of science includes a book on radioactivity (Gy. Zemplén, 1905), a translation of Marie Curie's book (Curie-Sklodowska, 1906), a book on electricity and its practical applications (Gy. Zemplén, 1910), notes on the translation of Poincaré's work (Poincaré, 1908) and dozens of articles for the general reader, many of which appeared in the journal *Communications in the Natural Sciences*.

While a number of studies highlight Zemplén's scientific achievements, his views on the status of scientific knowledge are less well-known. In an article *On the value of Science (A tudomány értéke)*, (Gy. Zemplén, 1906a)<sup>6</sup>, he openly questions the validity of scientific statements, and whether they can ever be considered "final". His argument highlights the crucial role of conventions in science, from the empirical foundations to the accepted rules of reasoning. According to his views, inter-subjectivity is necessary as a basis of observations in science, but cannot be guaranteed. In organizing phenomena, the method of induction is only permissible if our belief in the existence of laws of nature is accepted (as a "background assumption or basic hypothesis", p.20). But even the laws of logic and of our reasoning are not necessarily true. "But who decides on the laws of logic, who guarantees their correctness? It might be not a little disappointing that the answer to even this question is that nobody does; even the laws of logic are assumptions, hypotheses, or if you like it, axioms. The gist of the matter remains: these are laws which cannot be proven, rules, the correctness of which we cannot be ascertained of" (ibid.). Neither reasoning (which would use the same laws), nor experience (which can only result in inductive generalizations that have predictive power, but cannot prove the matter) can come to our help. "We therefore have to admit that even logic, which governs all the sciences and our whole life, is nothing more than a few assumptions" (p. 21).

This conclusion is very untypical of the ruling intellectual climate in Hungary, strongly preferring positivistic, scientific agendas at the time (for an illustration see Percz, 1998): “Taking a look at the sciences, we have shown that all of them – including logic and mathematics – are built on hypothetical foundations, or to formulate it differently, are the results of conventions that are significantly influenced by the human environment” (p.23).

The strong influence of French conventionalist thought (a current and fashionable view in the scientific “center”) is clearly visible in the work. The arguments presented are not philosophically novel or especially well worked out – but they show that a leading Hungarian scientist-teacher was well versed in the current views and debates about the status of scientific knowledge (personal acquaintance with Poincaré obviously played a part in this). Popularization of science was not detached from the philosophical reflection about science. Zemplén embraced anti-foundationalist views *but* believed in scientific progress – a position shared by leading contemporary figures, like Poincaré, Duhem, or Neurath<sup>7</sup>. Győző Zemplén’s work shows that it was possible to contribute to the development of science, to engage in furthering the public understanding of science and be up-to-date with respect to notions in the philosophy of science.

The development of physics in the twentieth century has surpassed most beginning-of-century expectations. It is in the realm of early science fiction (like the works of Jules Verne) where we find the best (visionary) descriptions of what the physical sciences have reached in one century. A pressing and troubling question is whether the teaching and popularization of science has undergone changes that even faintly resemble the developments of the sciences. As for Hungary, I will argue for the negative, or to rephrase the quote by Ferenc Pulszky: even today Hungarian science has not successfully reached the third phase of its development – 100 years after the announcement.

### 3. The Turn of the 21<sup>st</sup> Century and ‘Sceptic’ Popularizers of Science.

The popularization and teaching of science faces significant challenges throughout the world. In Hungary, the linguistic problem remains – and with the continuously accelerating development, the market trends not favouring long projects and the employment of adequately trained translators, the results are sometimes of staggeringly low quality.

But in the last years, promoters of the scientific world-view face new (or at least radically strengthening) challenges: the legitimacy of science and the scientific enterprise is more and more openly questioned in Hungarian popular culture (or at least so it is seen). Popularization for many of the Hungarian scientist-writers (and usually not science-writers, as most popularizers actively pursue an academic carrier) means more and more a bitter polemic against what they see as the enemies of science: pseudo-scientists, charlatans posing as scientists, etc. Symptomatic of this trend is the founding of the Society of Fact-Respecters (Tényeket Tisztelők Társasága), supported by a number of prominent media-personalities. So-called “Sceptical conferences” are regularly held, and the aforementioned *Communications in the Natural Sciences* (*Természettudományi Közlöny*, now also called *Természet világa*) now runs a “Sceptical corner”.

While the analysis of the popularization of science as it is pursued in the new media would be especially rewarding, I will only investigate a few pieces written or translated for the “Sceptical corner”. The reviewed journal plays a leading role in communicating novel scientific results to the general public, and especially to high-school teachers of the natural sciences and to interested students. It is also the journal in which Győző Zemplén had published at least 32 articles – making this cursory comparison less *ad hoc*.

To appreciate the special flavour of Hungarian popularization of science, let us first see a short editorial of the “Sceptical Corner”, titled “Only the real scientist can go wrong” (editorial, 2002). The article establishes a dichotomy: the real scientists are those who admit their mistakes, the posers are the ones who do not. The language used is emotionally loaded – thus influencing the reader – and the general statement in the title is supported by individual observations. The article is based on the English editorial “I Was Wrong - Those three words often separate the scientific pros from the posers” by Michael Shermer – founder of the *Skeptic Society* and *Skeptic* magazine (Shermer, 2001). The original is already not a value-free evaluation, since it is written by an ardent critic of non-traditional scientific practices, but the differences are highly significant. The English title admits a personal failure – and does not make a universal statement (which is false for obvious historical reasons), it only states what the difference “often” is. The Hungarian version uses a typical *argumentum ad baculum*, excluding from the discourse all who do not agree with the stated position: “As all real practitioners of science know...” in §3 – this, again, is missing from the original. A number of manipulative phrases are present only in the Hungarian version (like a sympathetic scientist, who “*has not hesitated for a second* to abandon his position as soon as he obtained the new data”).

Supposed dichotomies often appear in the “Sceptical Corner”: “Two medicines, the orthodox and the alternative, cannot coexist” (Rák, 2003). In general, the texts are only weakly argumentative, if at all – my favourite example is a short paragraph in an article attacking alternative medicine, where the only argument against drinking urine is that a Czech diplomat, who himself has used this therapy, left his office in Jemen when charged with corruption, leaving nothing but urine-samples of the employees behind (Mornstein, 2003)<sup>8</sup>.

In line with a number of analysts of the Public Understanding of Science movement (Gregory and Miller 1998) I strongly believe that the above-mentioned polemical writings do very little to promote the understanding of science. Their writers do not seem to possess knowledge and understanding of contemporary philosophies of science – or even hundred-year-old ideas. While in the first example, Győző Zemplén could be seen as a faithful promoter of then contemporary ideas about science, the recent examples show further and unnecessary radicalization of already radical (and not too well-argued, philosophically not much appreciated) views.

Though science develops and the role it plays in our everyday lives increases, the popularization of science in Hungary seems to have taken a different course and has become foundationalist (if not fundamentalist) and dogmatic in its assertions. The “Sceptical Corner” is by no means sceptical about the status of the assertions made, and unless the sentiments taken for granted in the articles are reopened for rational debate, I see little hope for the popularization.

#### 4. Conclusions

I have tried to show that not just the development but also the popularization of science took a different course on the “periphery” than in the “center” of Europe. The early aim was closely connected to a generally accepted national political agenda, and only the recent years brought new challenges to the “periphery”: the sciences are now seen as fighting for their own legitimacy, and the status of science is being questioned from different sides. This has always been recognized as a major problem in the “center” and popularization was seen as one of the remedies.

I consider most unfortunate the separation of the teaching and popularization of science from developing thinking about science. On the one hand, while attempts have been made in Hungary to base secondary science education thoroughly on the history of science (Both & Csorba, 1993), these have not become generally recognized. The status of the history of science in Hungary (as discussed in 1.2) render it a discipline producing biographies, chronologies, and anecdotes – and not arguments, that could be used for (or, for that matter, against) the popularization of science. On the other hand, science in Hungary has separated from the philosophy of science (where the significance of the history of science has increased radically in the last 40 or so years), partly due to the ideological commitments of the post World War regime. The results are clearly visible in the quality of arguments discussed in part 3. Thus, while a hundred years resulted in enormous development of science, in popularization it has not.

While strongly opposing the raising of national icons, I believe we do have something to learn from our forefathers: successful popularization must not only focus on the content of science, but has to take into consideration the status of science as well. To achieve this, up-to-date notions about the role of the history of science, and increased attention to the philosophy of science seem to be required<sup>9</sup>.



**Figure 1: Győző Zemplén**

## Notes

<sup>1</sup> Most of what I know about the history of Hungarian sciences, are, apart from family fables, thanks to László Kovács, József Németh, Gábor Palló, and László Vekerdí. I appreciate and thank their kindness in drawing my attention to so many things. I also thank the financial support of the Magyary Zoltán, and, for producing the final version the Békésy György post-doctoral fellowship as well as support from OTKA grant T 037575. Márta Fehér, Judit Gervain, and János Tanács gave very helpful comments on the manuscript. The paper tries to address issues important to the HSSE, but was presented as one of the talks commemorating the 125th anniversary of Győző Zemplén's birth – this explains the unusually 'local' scope. An earlier version of the talk appeared in the volume *Zemplén. The Scientist and the Teacher* (ed. L. Kovács), *Studia Physica Savariensa XI.*, Szombathely, 2004.

<sup>2</sup> Creating Hungarian scientific terms facilitated popularization, but at the same time separated the community from the center. The importance of this is highlighted in (Palló, 2004a).

<sup>3</sup> It can easily be argued that this process – the “translation” of science and the creation of new vocabulary – is still seen as one of the main aims of Hungarian popularization of science. As the history of certain disciplines show, the results can vary greatly. Just to give two examples: while in Chemistry the Latinised writing has been abandoned in favour of a phonetic (i.e. Hungarian) transcription, in certain branches of psychology the opposite trend can be observed: from the mid-century textbooks consciously establishing Hungarian alternatives for new *termini technici* (Harkai Schiller, 1944), today these terms are often replaced by Hungarian versions of English versions of Latin words.

<sup>4</sup> That this does not mean that the Romantics were anti-scientific or ascientific is clearly demonstrated by recent works, like (Cunningham, 1990). In Hungary, however, few have argued for this position (Steinle, 2004; G. Á. Zemplén, 2002, 2006). But, importantly, while a comprehensive book on Newton and Newtonianism would not neglect anti-Newtonian sentiments, Hungarians rejecting the scientific enterprise are generally not treated in works on history of science, only in e.g. literary histories (the best known 20th. c. example is the writer Béla Hamvas).

<sup>5</sup> The beginnings of his career resembles that of his younger brother, Géza Zemplén (1883-1956): students at the Eötvös College, and after peregrination became heads of newly established departments at the Technical University in Budapest. More on Géza's life is in (Móra, 1995). On the modernising role of the brothers at the Technical University see (Palló, 2004b). Győző's daughter, Jolán, also professor of (experimental) physics at the Technical University played an important role in the development of history of science writing in Hungary (G. Á. Zemplén, 2000).

<sup>6</sup> The journal *Szerda* was the immediate forerunner of the *Nyugat*, the foremost literary journal of the first half of the twentieth century. Edited by Antal Gundel, son of a famous restaurant-owner, the content was mostly decided by Zoltán Ambrus and Ignó (Fülöp). Apart from Győző Zemplén, the linguist Zoltán Gombocz (also former student of the Eötvös College) and György Lukács also published in the journal. I thank László Kovács for drawing my attention to this article, which, together with (Gy. Zemplén, 1906b) seems to have been left out from all the existing bibliographies of Győző Zemplén until 2004.

<sup>7</sup> It has to be noted that this combination is far from being trivial. Today anti-foundationalism is generally used as an argument against the unity of science – as seen in works like (Galison & Stump, 1996). That it is still a tenable position, see recent reevaluations of Otto Neurath, like (Cartwright, Cat, Uebel, & Fleck, 1996, Zemplén 2006).

<sup>8</sup> For the sceptical reader, here is the original, i.e. the Hungarian translation of the article: “Ennek az igen kétéseztétának a gurui szerint a vizeletben jelenlévő, nitrogénben gazdag selejtanyagok kiválthatják a fehérjékben lévő nitrogént. A vizeletről - a homeopátiás gyógytermékekhez hasonlóan - azt állítják, hogy a különböző bomlásfolyamatok eredményeképpen bizonyos betegségeknel keletkező anyagok nyomait tartalmazza. A vizeletfogyasztás nem csak a műveletlen rétegek között terjed. Jiri Cingros, a vizeletterápiáról szóló egyik könyv szerzője a cseh diplomáciai szolgálatban dolgozott, először Oroszországban, majd később Jemenben nagykövet is volt. Miután törvénytelen üzleti tevékenységgel gyanúsították a követségben, egyszerűen eltűnt, nem hagyva más hátra, mint a követség alkalmazottainak vizeletét tartalmazó üvegeket.” (Mornstein, 2003)

<sup>9</sup> While this article only tackles a narrow and local issue (for the reasons explained in footnote 1), many of the concluding remarks can be generalised. Even though the situation in works published in English is significantly better, textbook conventions and many attempts at raising public awareness in Nature of Science issues suffer from the same separation of professional history, philosophy, and sociology of science from the organs (and people) doing the popularization (see Zemplén 2007 for a less local case study).

---

## References

- Abonyi, I.: 1981, 'Zemplén Győző'. In I. Péntes (ed.), *Műszaki Nagyjaink, IV*, Gépipari Tudományos Egyesület, Budapest, pp. 305-323.
- Balogh, L., Grédics, G., & Kovács, L.: 1979, 'Zemplén Győző a tudós és tanár'. *Fizikai Szemle*, 321.
- Both, M., & Csorba, F. L.: 1993, *Tudománytörténet I*, Gondolat, Budapest.
- Cartwright, N., Cat, J., Uebel, T., & Fleck, L.: 1996, *Otto Neurath: philosophy between science and politics*, Cambridge Univ. Press, Cambridge.
- Cunningham, A., Jardine, N. (ed.): 1990, *Romanticism and the Sciences*. Cambridge Univ. Press, Cambridge.
- Curie-Sklodowska, M.: 1906, *A radioaktív anyagokra vonatkozó vizsgálatok* (Gy. Zemplén, Trans.), Franklin Társulat, Budapest.
- (editorial), B. G.: 2002. 'Csak az igazi tudós tévedhet', *Természet Világa* 3, 141.
- Fülöp, G., *Olvások, könyvek, könyvtárak*. Retrieved 06.22, 2004, from <http://mek.oszk.hu/01600/01647/01647.pdf>
- Galison, P., & Stump, D. J.: 1996, *The Disunity of science: boundaries, contexts, and power*. Stanford University Press, Stanford, Calif.
- Gregory, J., & Miller, S.: 1998, *Science in Public: Communication, Culture, and Credibility*. Plenum, New York.
- Harkai Schiller, P.: 1944 *Bevezetés a pszichológiába: A cselekvés elmélete*, Pantheon, Budapest.
- Kovács, L.: 1975, *A múlt hagyományaival a jövő fizikusaiért. Zemplén Győző és Mikola Sándor élete, munkássága (manuscript)*. Zalaegerszeg: MTESZ-ELFT.
- M. Zemplén, J.: 1961, *A magyarországi fizika története 1711-ig*, Akadémiai Kiadó, Budapest.
- M. Zemplén, J.: 1964, *A magyarországi fizika története a XVIII. Században*, Akadémiai Kiadó, Budapest.
- M. Zemplén, J.: 1998, *A felvidéki fizika története 1850-ig*. Magyar Tudománytörténeti Intézet, Piliscsaba.
- M. Zemplén, J., & Egyed, L.: 1970, *Eötvös Loránd*, Akadémiai Kiadó, Budapest.

- 
- Móra, L.: 1995, *Zemplén Géza*, Akadémiai Kiadó, Budapest.
- Mornstein, V.: 2003, 'Alternatív orvoslás és áltudomány – Egy biofizikus megjegyzései' *Természet Világa* **3**, 132-134.
- Nagy, F.: 1995, *Magyar származású Nobel-díjas tudósok*, MTESZ, Budapest.
- Nemes, T.: 1989, 'A Kollégium és az École Normale Supérieure kapcsolatai (1897-1947)'. In J. Z. Nagy & I. Szijártó (eds.), *Tanulmányok az Eötvös Kollégium történetéből* (Vol. X), Eötvös József Kollégium, Budapest.
- Németh, J.: 1998, *Műszaki fejlődés - természettudományos műveltség. Műszaki és Természettudományi Egyesületek, Társaságok Magyarországon*, MTESZ, Budapest.
- Palló, G.: 2004a, 'A recepció és kreativitás összefüggése a magyarországi tudományban'. In G. Palló (ed.), *A honi Kopernikusz-recepciótól a magyar Nobel-díjakig*, Áron Kiadó, Budapest, pp. 7-22.
- Palló, G.: 2004b, 'Tudományos intézmények, konzervativizmus, kreativitás. A Budapesti Műszaki Egyetem modernizáló szerepe'. In G. Palló (ed.), *A honi Kopernikusz-recepciótól a magyar Nobel-díjakig*, Áron Kiadó, Budapest, pp 269-290.
- Percz, L.: 1998, *A pozitívizmusról a szellemtörténetig. Athenaeum, 1892-1947*. Osiris, Budapest.
- Poincaré, H.: 1908, *Tudomány és föltevés*. Királyi Magyar Természettudományi Társulat, Budapest.
- Rák, K.: 2003, 'Merre tart az orvostudomány? "Nem lehet kétféle medicina, ortodox és alternatív"', *Természet Világa* **4**(134), 174-175.
- Shermer, M.: 2001, 'I Was Wrong - Those three words often separate the scientific pros from the posers', *Scientific American* (Oct. 16.).
- Simonyi, K.: 2000, 'A magyarországi fizika kultúrtörténete. XIX. Század', *Természet Világa*, special issue (I)(130), 1-100.
- Steinle, F.: 2004, 'Egy romantikus kísérlet története', In M. Fehér, B. Láng & G. Zemplén (eds.), *Tudás az Időben*, Műegyetemi Kiadó, Budapest.
- Tanács, J.: 2001, 'Rejtőzködő párhuzamosság', *Magyar Filozófiai Szemle* **4**(45), 473-489.
- Vekerdi, L.: 1996, *"A Tudománynak háza vagyona". Reáliák a Régi Akadémia terveiben és működésében*. Magyar Tudománytörténeti Intézet. Tájak-Korok-Múzeumok Egyesület, Piliscaba.

---

Zemplén, Gy.: 1905, *A testek radioaktív viselkedéséről* (Vol. 82), Természettudományi Társulat, Budapest.

Zemplén, Gy.: 1906a, 'A tudomány értéke', *Szerda* **1**(I), 17-23.

Zemplén, Gy.: 1906b, Tudománykritika. *Szerda* **6**(I), 300-304.

Zemplén, Gy.: 1910, *Elektromosság és gyakorlati alkalmazása* (Vol. 82), Természettudományi Társulat, Budapest.

Zemplén, G. Á.: 2000, 'Zemplén Jolán', In *Asszonyorsok a 20. században*, BME Szociológia és Kommunikáció Tanszék, Budapest, pp. 99-107.

Zemplén, G. Á.: 2002, 'Megroppant szivárvány?', In G. Forrai & T. Margitay (eds.), *Tudomány és történet*, Typotex, Budapest.

Zemplén, G. Á.: 2006, 'The development of the Neurath-principle: unearthing the Romantic link' *Studies in History and Philosophy of Science A* **37** (4):585–609.

Zemplén, G. Á.: 2007, 'Conflicting Agendas: Critical Thinking versus Science Education in the International Baccalaureate Theory of Knowledge Course' *Science and Education* **16**:167–196.