

THE OSTWALD-GIBBS CORRESPONDENCE: AN INTERESTING COMPONENT IN THE HISTORY OF THE ENERGY CONCEPT

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In the late 1800s and early 1900s, one of the premier figures in German chemistry and physics was the eminent natural philosopher and scientist Wilhelm Ostwald. Early in his career Ostwald developed a strong interest in the concept of energy from both the perspective of the philosopher and the outlook of what was later to be called the physical chemist. He became a leader in a community of scientists with somewhat similar leanings who called themselves energeticists (1). They supported and promoted what they hoped would become a universally accepted cosmological construct based on the unifying concept of energy (2). This energy-based paradigm embraced thermodynamics as an integral part of its structure.

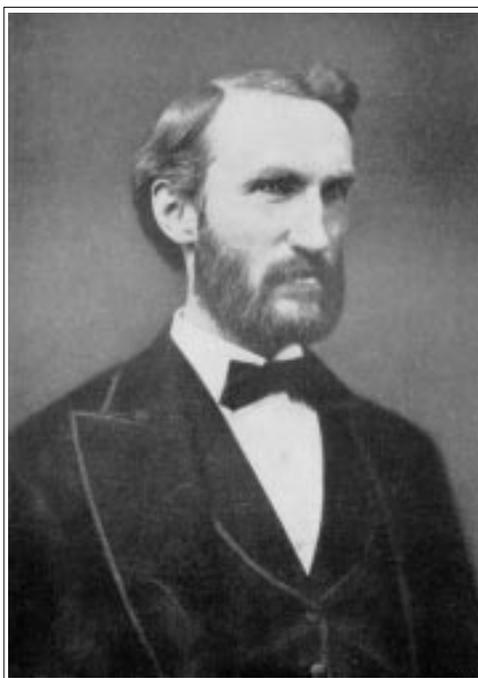
As a consequence of this view, for a time Ostwald did not subscribe to matter-based atomic models and even declared that the concept of matter itself was superfluous and that the intrinsic phenomena experienced in physics and chemistry could be accounted for satisfactorily by analyzing energy transformations (3).

In support of the energy cosmological model, in 1892 he wrote (4):

Thatsächlich ist die Energie das einzige Reale in der Welt und die Materie nicht etwa ein Träger, sondern eine Erscheinungsform derselben. (Actually energy is the unique real entity (das einzige Reale) in the world, and matter is not a transporter (Träger) [of energy] but rather a state of the former.) (5)

This energy-mass equivalence concept was later stated by Einstein and by G. N. Lewis (6, 7).

Ostwald's deep and abiding interests in energetics most likely were the motivating forces that caused him forcefully and tenaciously to approach Josiah Willard Gibbs (who was to become a prominent figure in American science) with the proposal that Gibbs rewrite and republish his masterpieces on thermodynamics. In addition, Ostwald went so far as to advise Gibbs that he should republish those in an easily accessible and widely distributed journal. He also suggested to Gibbs that he could make these tracts still more generally avail-



Josiah Willard Gibbs

able if he would have them translated into the German language (8).

However, history has shown that to convince the obdurate Gibbs to republish would take not only the prestige of the distinguished scientist and scholar, Ostwald, but also his considerable diplomatic skills as the editor-manager of a new journal (9). Yet even the talented and gracious Ostwald was never able to induce Gibbs to do a rewrite.

The correspondence between Ostwald and Gibbs — a total of twenty letters written between 1887 and 1895 — was initiated by Ostwald by way of a letter dated April 26, 1887. In this inaugural letter (No. 88) Ostwald stated his purposes for contacting Gibbs were, first, to invite Gibbs personally to contribute to the new journal *Zeitschrift für physikalische Chemie* and, second, to request and encourage Gibbs to revise and reprint his thermodynamic treatises — which he had published in the “Transactions of the Connecticut Academy of Art & Sciences” — in a place where they would be more easily accessible (10). At the time of his first letter to

Gibbs, Ostwald was near the zenith of his career as a scientist. This productive period (~1887) was marked by the following: appearance of his landmark textbook *Lehrbuch der allgemeinen Chemie*, which came to be called *Der grosse Ostwald*; his establishment, with Jacobus Henricus van't Hoff, of the *Zeitschrift für physikalische Chemie*; his ascent to the Chair of Physical Chemistry at Leipzig; and his acquisition of Walther Nernst and Svante Arrhenius to add to his outstanding group of assistants.

Gibbs, fourteen years older than Ostwald, was perhaps past the summit of his career at the time of the first letter from Ostwald. Following his masterpieces on thermodynamics, as well as the rest of his career, Gibbs seems principally to have concerned himself with his teaching and his very productive research in pure mathematics and statistical mechanics. These latter works did not bring him the renown among chemists he had been accorded by his earlier fundamental publications on thermodynamics. Relying heavily on the language of mathematics, Gibbs employed a very condensed style

Letter No. 88 (14, 15)
Ostwald to Gibbs
Riga Polytechnic Institute
Laboratory of Chemistry
26, April [18] 87

My dear Colleague:

Since the beginning of this year, I have been publishing in collaboration with J. H. van't Hoff a journal of physical chemistry, stoichiometry, and chemical affinity. Supported at the beginning by association of a number of prominent peers, I now have the honor to count as collaborators to the journal nearly all the researchers of importance in this branch of science. This encourages me to approach you also and to ask that you participate in the journal by contributing papers as well as by allowing me to quote your name among the contributors. If you are not comfortable in expressing yourself in German, I shall gladly provide for the translation from English.

I should like to take this occasion to express a desire that many professional colleagues share with me. Your comprehensive treatise in **Vol. III** of the “Connecticut Transactions,” which is fundamental for the application of thermodynamics to chemical problems, is not readily accessible; couldn't you decide to reprint it in a revised form that is expanded and illustrated with examples of which there is now no lack? I cannot deny that at present the study of your work is pretty difficult, particularly for the chemist, who is usually not at home in a mathematical treatment. I would be most happy if you would decide on a German edition; the provision of a publisher and the execution of the translation I will gladly take care of. Thereby, the study of these areas, particularly in Germany, would gain wider distribution than is presently the case.

Please excuse me for writing in German. I understand enough English to be able to read it, but I am not sure that I am expressing correctly what I mean when I write in English.

Yours respectfully,
Professor Dr. Wilh. Ostwald
Chemical Laboratory, Riga Polytechnic Institute, Russia

of writing. It did not endear him to his readers, who found that his parsimonious use of words and his lack of examples and graphics made his original and fundamental treatments of thermodynamics very difficult to understand.

Josiah Willard Gibbs (1839 - 1903) was the only son in the family of five children born to Josiah Willard Gibbs, Professor of Sacred Literature at Yale, and Mary Anne Van Cleve. He attended Yale College and obtained an undergraduate degree with honors in both Latin and mathematics. Later he wrote a thesis on a mathematical treatment of gears, for which he was awarded Yale's first doctorate in engineering. In 1863 Gibbs, having completed the doctorate, received a three-year faculty appointment as a tutor at his alma mater. He taught Latin the first two years and natural philosophy (physics) the third year. Then he and his two sisters rented their house and departed for Europe to study abroad. He studied mathematics and physics in one-year stints at Paris, Heidelberg, and Berlin (11). When he returned to New Haven, three years later, he accepted a nonpaying appointment at Yale as Professor of Math-

ematics and Physics, a position he held for nine years. Finally he became a salaried professor when Johns Hopkins tried to lure him away from Yale (12). He held the Yale faculty position until his death in 1903.

In his introductory letter Ostwald presented Gibbs with several items that would require a substantial amount of work (13). The first was couched in a very warm and friendly invitation to become a contributor to the new journal *Zeitschrift für physikalische Chemie*. The second, almost an entreaty, was to republish his thermodynamic works in an accessible journal. The third was a request to do a rewrite of his treatises. At this third point Ostwald lapsed into the role of editor and critiqued the treatises, pointing out to Gibbs that he thought the works should be expanded, that there should be more examples, and that now ample examples were available. He made the point that the work was perhaps excessively mathematical and that chemists, who often were lacking in mathematics preparation, would certainly have difficulty with it. In addition he suggested he would be most happy if Gibbs would decide to publish a German edition.

Gibbs, not surprisingly, laid the Ostwald letter aside for about three months, finally replying on August 3,

1887 (No. 89). In this handwritten communication he indicated no interest in following up on any of Ostwald's suggestions or requests.

Letter No. 89 (16)

Gibbs to Ostwald
New Haven Conn.
Aug 3 1887

Dr. W. Ostwald
My dear Sir:

Please accept my apologies for my delay in replying to your very kind letter. Some points required a certain consideration (the more, as at that time I had not yet seen your valuable Journal), & when I had laid your letter aside, the pressure of other engagements prevented me from returning to it.

I am very glad that you have undertaken a Journal of this character, for which there seems to be an abundant opening. The subject is one in which I have felt a lively interest, & to which although my time for the last years has been given almost exclusively to other subjects I have always hoped to be able to return.

Nevertheless I am not able to make any engagements, but can only assure you of my good wishes for your undertaking & my grateful appreciation of your kind interest in my own work.

I remain
Yours very respectfully,
J. Willard Gibbs

Despite this reply, Ostwald, who considered energy and energy transformations fundamental to all phenomena and processes, was assiduous in his pursuit of information relating to energy and consequently pressed Gibbs for his cooperation. As further exemplified a few years later, he proposed with characteristic zeal what amounted to a secular religion based on energy (17), which may have further alienated him from the Leipzig humanities faculty and contributed to his retirement from Leipzig in 1906.

Ostwald, in addition to writing Gibbs, enlisted the aid of a former student, Morris Loeb, to try to procure a copy of Gibbs' treatise. Loeb's response is described in a German language footnote appended by a previous investigator to the information on letter 90. **Our translation follows:**

Since you had already asked me in June to get you a copy of Willard Gibbs' Treatise, you probably are astonished not to have it yet in October. When I arrived in New York 8 days ago, my first errand was to my book dealer, who let me know that the book doesn't exist at all at book dealers, since the Conn. Academy prints only for members, etc. And there is

Letter No. 90. (18, 19)

Gibbs to Ostwald
New Haven Oct 26 1888

My dear Sir:

I hear through Mr. Loeb (now I believe in Newport R I) that you are desirous of obtaining a copy of my "Equilibrium of Heterogeneous Substances." My extra copies have been long since exhausted, it can only be obtained by purchasing Vol. III of the "Transactions of the Connecticut Academy," of which it constitutes a large part (325 pp). This will be sent to any address by the secretary Mr. Addison Van Name (New Haven, Connecticut) on receipt of the price \$6.00 by International Post Office money order or otherwise.

I send by book-post a few minor papers on kindred subjects, of which I beg your kind acceptance.

I remain
Yours very truly,
J. Willard Gibbs

no hope to get it by chance as second hand. This is why I immediately talked to Professor Wolcott Gibbs, whose assistant I have become, and induced him to write to Willard Gibbs and ask him to directly forward you a copy of the desired. I hope that this will soon occur, and thus I will be able, even though late, to fulfill your wish.

Gibbs responded to the request of the treatise through Mr. Loeb in a letter (No. 90) dated October 26, 1888. Gibbs also included a few of what he described as minor papers for consideration for publication in Ostwald's and van't Hoff's new journal.

Ostwald repeated his request for permission to publish a German translation of Gibbs' treatises (No. 91). It is worth noting that when Gibbs finally reluctantly gave his permission for Ostwald to publish a German translation, Ostwald was about half finished with the translation.

Letter No. 91 (20)

Ostwald to Gibbs
Editorial Staff of the
Zeitschrift für physikalische Chemie
Prof. Dr. W. Ostwald
Brüderstr. 34
Leipzig, 14. Nov. 1888

My Dear Sir:

Please accept my warmest thanks for the gracious notification about the manner by which I can acquire a copy of your large treatise; I have just written Mr. Addison van Name and forwarded him a money order for 6 dollars. Likewise, I thank you very much for the courtesy of sending the separate copies of the forwarded papers; I hope soon to be able to reciprocate the kindness.

Would you object if I would publish a German translation of your fundamental work? It is accessible with such great difficulty and contains so much important material that such an attempt appears to be very useful. If you generally agree, I will make you some suggestions about the form.

Respectfully,
Yours truly,
W. Ostwald

Gibbs wondered whether the utility of a German edition justified the cost of translation and publication (No. 92).

Letter No. 92 (21)
Gibbs to Ostwald

New Haven 1888 Dec 7 1888
Professor W. Ostwald

My dear Sir:

I should be very glad to have my essays in Thermodynamics made accessible to a larger circle of readers. Yet I should have feared that the call for a German edition would hardly justify the labor & expense of the translator & publisher. If, however, you think differently, I should be glad to hear from you more definitely in regard to what you think practicable.

With thanks for your kind interest in my work,

I remain,
Yours truly,
J. W. Gibbs

On Christmas Day 1888 Ostwald wrote Gibbs a post card (No. 93) and described to him his idea of publishing the series of small volumes which became known as *Ostwalds Klassiker der exakten Wissenschaften*.

Letter [Post Card] No. 93 (22)

Ostwald to Gibbs
Leipzig, Dec. 25, 88

Most Distinguished Colleague:

I am planning next year to prepare an edition of classical essays from the fields of physics and chemistry which will be issued as individual bound publications and will have the purpose of making easily accessible the knowledge and use of the original works which have brought about the development of science (23). I would like to publish your work in this form. Whenever the plan has developed sufficiently, I will give you the details.

Respectfully yours,
W. Ostwald

The establishment and publication of this famous collection belongs among the important achievements of W. Ostwald in the field of the organization of science.

At this point Gibbs informed Ostwald that Veit & Company of Leipzig had shown an interest in publishing his treatises, even to the extent of doing a German translation. Gibbs gave Ostwald a quote from a Veit & Company letter (No. 94). Then he wrote, "I shall be glad to hear in regard to the maturing of your plans as soon as may be."

Letter No. 94 (24)

Gibbs to Ostwald
New Haven Jan 17 1889
Professor Wm Ostwald

My dear Sir,

I have received a letter from Veit & Comp. (Leipzig [Leipzig]) offering to republish my papers on Thermodynamics in English or German. With reference to a translation they say:

"In the last case (if I should prefer a translation) we would get support from the very distinguished Professor Felix Klein at Göttingen—who became friendly with us—in preparing the edition in the best way, that is to say by helping us to find a suitable translator and supervising the translation." (25, 26)

I have replied that I had already received a proposition of a similar nature from you, & that I was waiting to have the details of your plan. Of course I said nothing in regard to your farther purposes wh[ic]h you mentioned in your postal card.

I shall be glad to hear in regard to the maturing of your plans as soon as may be.

Very truly yours,
J. Willard Gibbs

In the letter that follows (No. 95) one sees Ostwald the organizer and facilitator at his very best. It is possible that this gift of the ability to organize may have obscured another facet of Ostwald — *i.e.*, Ostwald the thinker.

Letter No. 95 (27)

Ostwald to Gibbs

Prof. Dr. W. Ostwald
Brüderstr. 34
Leipzig, 30. Jan. 1889

Dear Colleague,

The plan, which I recently suggested to you, will consist of publication of a series entitled *Classiker der exacten Wissenschaften*, [Classics of the exact Sciences] which will contain, in separate volumes, the reprint of a word for word text of papers which have had or will have an important influence on the development of science. I will be able in the very near future to send you a prospectus. The first issue, Helmholtz's "*Erhaltung der Kraft*" [Preservation of Energy], will soon reach the bookstores.

In this series of classics I was planning to print your large treatise, but in a German translation, that I will either take care of personally or at least have done under my supervision (28).

It is evident that you will have complete freedom of decision under which form [language] you will prefer to issue that in any case, very desired new publication of your works. I can only add that it will bring me great pleasure if I can contribute something to help to get your researches the circulation they deserve.

Whatever the costs of the translation, etc. amounts to will be underwritten by the publisher. Of course I cannot offer you an honorarium or only a very small sum since the publication should be brought on the market as cheaply as possible and already the costs of the translation are coming into question.

Respectfully yours,
W. Ostwald

On February 16, 1889, Gibbs wrote to Ostwald (No. 96) that Veit and Company had made him a better offer. He proposed to publish with them if they could find someone to do the translation. He indicated that he had no doubt that Veit and Company could find a suitable

translator. He thanked Ostwald for his kind interest in the matter and seemingly terminated the discussion of publication. One is free to speculate as to how Ostwald, a power in the fields of physics and physical chemistry, may have reacted privately to Gibbs' rejection of his generous offer.

Letter No. 96 (29)

Gibbs to Ostwald
New Haven Febr 16 1889

My dear Professor Ostwald:

Your very kind letter of Jan. 30 is rec[eiv]ed. It would be very gratifying to me to have my paper appear in such a Collection as you propose to publish & of course I highly appreciate the advantage of having the translation made by yourself or under your supervision. Under any other circumstances, I should most gladly accept your offer. In one point, however, Veit & Co have made a more comprehensive proposal, in that they include *all* my papers on Thermodynamics, i.e., three minor papers with the long one ('Equil. Het. Sub.'). These other papers are doubtless of minor importance, yet I naturally feel a certain pleasure in having them included (30). Of course I see that such a publication of *all* the papers could be quite out of place in your collection.

If therefore Veit & Co can give satisfactory guarantees of a creditable translation, as I have no doubt from their letter that they can, I shall feel that it is best for me to accept their proposal, but I shall not the less appreciate the very kind interest wh[ic]h you have shown in the matter.

Yours very sincerely,
J. Willard Gibbs

Ostwald, without Gibbs' permission, then published a letter from Gibbs to Professor Oliver J. Lodge in the *Zeitschrift für physikalische Chemie*. The letter (No. 97) dealt with the relationship between chemical and electrical energy.



Wilhelm Ostwald

Letter No. 97 (31)

Ostwald to Gibbs

Editorial Staff of the
Zeitschrift für physikalische Chemie
Prof. Dr. W. Ostwald
Brüderstr. 34
Leipzig
March 31, 1889
My dear Colleague,

As you will learn from the enclosed copy, I took the liberty to translate your letter mailed to Prof. Lodge, about the relationship between chemical and electrical energy, and to publish it in the journal, which I am editing (32).

I hope you won't be offended that I have taken this action without first consulting you, but the letter appeared to me to be so interesting, that I didn't want to deprive my readers of its contents, by just waiting for the time consuming letter exchange to America and back.

Should you so desire, I shall gladly provide you with several copies of the German reprints.

Yours truly,
W. Ostwald

Ostwald negotiated a transaction with Veit & Co., which would lead to a transfer of the copyrights to the German translation of Gibbs' treatise on thermodynamics (No. 98). He now was in a strong position from which to ask Gibbs again to consider updating the treatises by writing some notes. He even added a monetary incentive by offering Gibbs a "reasonable honorarium."

Letter No. 98 (33)

Ostwald to Gibbs

Prof. Dr. W. Ostwald
Brüderstr. 34
Leipzig
3 March [18] 91

Very honorable Colleague:

Some time ago, at my request for the copyrights to a German edition of your fundamental work, you wrote me that you had transferred them to the publisher, Veit & Co, Mr. Credner (34). Mr. Credner, with whom I have a friendly relation, recently said that he has not been able to find a suitable translator, and he is ready to cede these rights to me. Now I would like to propose to you that the German translation of the work *On the Equil. of Hetero. Subst. and, possibly in addition, the work On the Geometr. Repr. by Surfaces* be issued together, as a separate volume (35). Please tell me whether you possibly could write some notes to the earlier work that would reflect the present point of view of science.

The importance of your work is so great that I would like to do all that I can to procure for it an appropriate dissemination.

As the situation is, I can hardly promise you a pecuniary return of significance, but for the notes a reasonable honorarium could be made available.

Yours very truly,
W. Ostwald

Gibbs gave Ostwald verbal permission to publish the German edition, but he did not agree to write explanatory notes, although he promised to take the note writing under consideration (No. 99).

Letter No. 99 (36)

Gibbs to Ostwald

New Haven, Mch 27 1891

Dear Professor Ostwald:

If Veit & Co (not finding a suitable translator) are disposed to give up the matter to you, & you are still disposed to undertake it, I think that you had better do so, & should be very glad to have you.

I think that your proposal to include the paper on the "Geom. Rep. by Surfaces" is a judicious one. That is doubtless the most important of the minor papers. It contains, I believe, the first solution of a problem of considerable importance, viz: the additional condition (besides equality of temperature & pressure) with [*sic*] is necessary in order that two states of a substance shall be in equilibrium in contact with each other. The matter seems simple enough now, yet it appears to have given considerable difficulty to physicists. (See Clausius, *Wied. Ann.* IX, p. 355, 1880, where he gives the solution in a somewhat different form (37).) I suppose that Maxwell referred especially to this question when he said (*Nature* XI, p. 359) that by means of this model, problems which had long resisted the efforts of himself & others, could be solved at once (38). In the 4th Edition of his "*Theory of Heat*" he gives several pages to this geometrical representation.

Moreover, the treatment of a homogeneous body in this paper is really identical in spirit, with my treatment of heterogeneous bodies in the longer paper, (except that the latter does not admit of the simple geometrical representation), & I think that its previous perusal is very well adapted to diminish the difficulties which students may feel in reading the latter.

In regard to notes, I cannot make any engagement at present, but I will think about it, & write you again, at least if I hear that the matter has been definitely arranged between you & Veit & Co.

Yours faithfully,
J. Willard Gibbs

Ostwald moved rapidly ahead. The problem of copyrights having been settled, he was about halfway through the translation into German. Then he made an-

other appeal for the notes, reminding Gibbs that he still had time to complete the task (No. 100).

Letter No. 100 (39)

Ostwald to Gibbs

Editorial Staff of the
Zeitschrift für physikalische Chemie
Prof. Dr. W. Ostwald
Brüderstr. 34
Leipzig, April 12, 1891

Dear Sir,

The agreement between Veit & Co. and myself is already completely settled since Herr Credner, the owner of the firm, with whom I am on friendly terms, completely agrees to transfer to me all rights that he would have, for the publication of a German translation of your work. Since I already have it about half translated, as soon as I am finished, I intend to start the printing so that the German edition could be finished by autumn.

While I thank you very much for your kind consent, I mention that in case you decide to write annotations for the German edition, these would be needed at the completion of the printing of the text (40). Thus, you still have perhaps some 6-8 months' time, and then the annotations would be put in an appendix.

Yours very truly,
W. Ostwald

Ostwald expressed his very high regard for Gibbs' treatises (No. 101). He also lapsed into the role of editor and chided Gibbs a bit about publishing a huge vol-

ume in a virtually inaccessible journal. He used the occasion to inquire once again about the subject of notes.

Letter No. 101 (41)
Ostwald to Gibbs

Editorial Staff
Zeitschrift für physikalische Chemie
Prof. Dr. W. Ostwald
Brüderstr. 34
Leipzig, Aug. 9, 1891

Very honorable Colleague,

Since in the next few days the first galley proofs of the German translation of your highly important works will reach you, I take the liberty to ask that you look over these and the sheets to follow to determine whether I have assessed and properly rendered the not always easy to understand meaning of your presentations.

If you also would take a glance at the formulas, that would be helpful to the German edition. Please disregard the many typographical errors committed by the typesetter, who is not yet accustomed to my handwriting; I am going to read two revisions and shall make the utmost effort to eliminate them.

The translation of your main work is nearly completed; I cannot forgo in this place to express repeatedly my admiration to you. If, over a long span of time, you would have submitted this work in single papers to an accessible journal, you presently would be not only known in the narrow circle of discriminating judges, but also would be considered everywhere not only the greatest thermodynamics expert since Clausius, but also one who far surpasses him in many cases with respect to rigor and versatility of judgment. I hopefully the German translation will lead more promptly to the recognition you have earned.

Meanwhile, have you considered the question of some notes?

With special high regard,
Very respectfully yours,
W. Ostwald

Letter No. 102 (42)
Gibbs to Ostwald
Goshen, Mass.
Aug 16/ [18] 91

My dear Dr Ostwald:

I am much obliged to you for the elegant typographical form which the printer has given to my "Thermodynamic Studies" & for the care with which the translation has been made.

I have corrected such typographical errors as I have noticed, although I have not been able to compare with the original. In one or two places a word seems to have slipped out. In the second sentence (page 1) is not a verb wanted after Flüssigkeit, meaning to "indicate" or "represent?"

In the first note on page 3 after the parenthesis do we not want "can be derived" or something like it? I see that the formulae are printed entirely in *Roman* type. The usual & I think the best practice is to use *Italics* (except perhaps for Capitals) for letters and algebraically.

I suppose the printer set it up without thinking anything about it. It seems a pity to commence on a long work, without commencing in the best way. But if it is too late to change in this article, I would suggest that the change be made in the next. I give my printer a standing order to put such things in *Italics*, except $\log \sin \tan$ & *c*. But this is a purely typographical matter, which you will of course arrange with the printer as you think best.

It is very hard for a printer to set up formulae correctly from manuscript. As soon as I return to New Haven (in two weeks), I will send you an *imperfect copy* of my longer paper which you can use to cut out formulae for the printer (or give it to him whole). You may also find it useful in preparing the figures. — On page 8 we have W^c H^c \sum^c and W^8 H^8 . The indexes ought to be of the same size both large or both small. — I think I would put the date on the first page. I have it not with me, but you must have it.

Very truly Yours,
J. W. Gibbs

Letter No. 103 (43)

Ostwald to Gibbs

[After Aug. 16, 1891] (44)

Dear Sir,

Today I received sheets 2-4 with your corrections, which, I am sorry to say, convince me how necessary it is for you to look it over. Please accept my warmest thanks.

I have talked with the publisher about the "italics;" they will be used throughout instead of the commonly used typeface. Even if the first sheet is already printed, the use of Italics in the formulas in the main publication will certainly be carried out. An issue of the original is now in the hands of the typesetter, so that in the future also fewer errors in the formulas will occur.

I cannot find the dates of your works on the publications; I plan to publish these and a few historical notes in a short foreword. Also, I would like very much to put your picture in front, and would be much obliged if you would agree to send me a good, if possible, fairly large picture of you; even better would be a negative (octavo format).

With best regards,
W. Ostwald

Letter No. 104 (45)

Ostwald to Gibbs

Editorial Staff

Zeitschrift für physikalische Chemie

Prof. Dr. W. Ostwald

Brüderstr. 34

Leipzig, Nov. 23, 1891

Dear Colleague,

Your errata, as you desire, will be appended to the text; the table of contents shall, as customary in German publications, go to the front and be enlarged to include the first two papers. Since, unfortunately, you cannot write any notes for it, I ask you please to write at least a foreword for the translation that would in particular contain the dates of publication of your works.

I would like again to repeat my desire to include your picture; should you send a negative, the reproduction expenses would be minimal, and since I confidentially hope that through the translation the recognition of your work will make a great advance, I find the inclusion of a picture quite suitable. I will gladly mention in my foreword that this has happened at *my* explicit desire.

Sheet 15, of which I sent you yesterday a new copy, has meanwhile arrived. You do not need to send a new correction.

With best regards
Yours very truly,
W. Ostwald

Letter No. 105 (46)
Gibbs to Ostwald
New Haven Dec 11/[18]91
My dear Professor:

With regard to the preface, I think that such an one as you may write will be amply sufficient.

The dates of which you speak are as follows:

Vol II Part 2 of Trans. Conn. Acad. containing my two first papers was published in Dec 1873.

Vol III Pt. 1 containing the first part of *Equil. Het. Sub.* was published in June 1876.

Vol III Pt. 2 containing the remainder was published in July 1878.

You will see that the printer has put his date on each folio, as it was "closed" for printing.

My private edition of "Graphical Methods" was distributed six months before the volume of which it formed a part.

I also distributed a few advance sheets from the *Equil. Het. Sub.*, so that Maxwell noticed the same in the South Kensington Science Conferences in May 1876 (See *Conferences & c* p. 145).

I give these details because you have asked for them. But I think it quite sufficient to say in the *Inhaltverzeichnis* under Graph. Methods & c (from the "Transactions of the Connecticut Academy of Arts & Sciences," Vol II, 1873); under Method of Geom. Representation (same as before); under *Equil. Het. Subs.* (from & c Vol III, 1876-8).

I may add that the American Academy of Arts & Sciences (Boston) awarded to me in 1880 their Rumford gold medal for these papers. If you mention this fact you should do it in such a way that it will not be confused with Rumford medal of the Royal Society of London. (Count R. founded a medal in each Society.) (See *Proceedings Amer. Acad.* Vol XVI, p 407 & 417, May 25, 1880 and Jan. 12, 1881.) (This journal you will doubtless find in the Library of the Royal Saxon Academy if not in other libraries.)

I thank you very heartily for the interest which you have expressed in the matter of the portrait, but I think as before that it would be hardly worth while.

I think that you should refer to my paper "On the Vapor-Densities of Peroxyde of Nitrogen & c" in the *American Journal of Science*, Vol XVIII, 1879, wh[ic]h is in fact a continuation of the subject discussed under the head "Gas-mixtures with convertible Components", pp 234 - 248 of *Equil. H. S.* It does not I believe add anything to the *theory*, but it gives a more detailed comparison with experiment.

Very truly Yours,
J. W. Gibbs

P. S. Possibly you may think it worthwhile to refer to my letters on the electromotion force of galvanic cells in the *British Assoc. Reports* for 1886 & 1888, one of which you translated in your Journal. They relate to the last subject treated in the *Equil. Het. Subs.*

J. W. G.

Letter No. 106 (47)
Ostwald to Gibbs

[Leipzig,] Apr. 18, (18) 95

My dear Colleague,

I have the urgent wish to dress up this set of volumes of my journal with your picture and use the occasion that a former student, Dr. Coggeshall, is traveling through New Haven, and through him to relay this request to you. A negative (Cabinet-Format, approximately 12 x 16 cm) would be the most desirable for me.

In the hope of a favorable answer I remain

Yours very truly,
W. Ostwald

Letter 107 (48)
Ostwald to Gibbs

Prof. Dr. W. Ostwald
Brüderstr. 34
Leipzig
November 14, 1895

Dear Colleague,

Today I received the negative. My heartiest thanks! I am very pleased through the publication of the picture to express additional witness to the respect all of us owe you. The reimbursement for the negative will soon be sent to you by the publisher; should you desire some reprints made by the photogravure, it will be a pleasure to provide them for you.

Yours very truly,
W. Ostwald

Letter No. 108 (49)
Gibbs to Ostwald

New Haven Dec 7 [18]95

My dear Professor Ostwald:

I am glad that the negative have [*sic*] reached you safely.—I should be pleased to have half a dozen copies of the reproduction.

Yours faithfully,
J. Willard Gibbs

P.S. I have received from your publisher the \$3.00 wh[ich] I expended.
J. W. G.

Conclusion

Wilhelm Ostwald, with dogged persistence, clever negotiating, and good management skills, buttressed the energy concept by making readily available to the science community the hitherto virtually inaccessible thermodynamic treatises of J. Willard Gibbs. The closure of the Ostwald-Gibbs' correspondence occurred harmoniously with Gibbs seeking to place a student in Ostwald's laboratory at Leipzig.

The opinion is sometimes expressed that Wilhelm Ostwald was one of the supremely effective organizers

Letter No. 109 (50)

Gibbs to Ostwald

New Haven, 16 March, 1896.

(This communication consisted of a letter of recommendation from Gibbs to Ostwald for an American chemist, B. B. Boltwood, who wished to work for a semester with Ostwald in Leipzig.)

of science, but that his creativity in the matters of science was no match to that of some of his assistants such as Svante Arrhenius and Walther Nernst. There is no question as to the potency of his organizational and administrative abilities, as is shown by his effective dissemination of Gibbs' contributions to thermodynamics.

But the question of level of intellectual creativity warrants further consideration. A monistic concept of energy was central to the theme of Ostwald's research. His enormous academic effort along this research pathway produced major textbooks, ninety Ph.Ds, and a number of other creative scholars; and his research laboratory turned out significant scientific achievements stemming from his energy paradigm. In 1909 he was awarded the Nobel Prize for his contributions to reaction kinetics.

REFERENCES AND NOTES

1. R. J. Deltete, *The Energetics Controversy in the Late Nineteenth-Century Germany: Helm, Ostwald and their Critics*, Ph.D. Thesis, Yale University, 1983, Vol. I, 120.
2. Ostwald later in his career devoted much of his study to monism, any doctrine based on the assumption of a single underlying principle. Ostwald believed in the mass-energy equivalency principle which was later formulated as $E = mc^2$.
3. W. Ostwald, "Referat über W. Wien, 'Über den Begriff der Lokalisierung der Energie,'" *Wied. Ann.* **1892**, 45, 685-728," *Z. physik. Chem.*, **1892**, 9, 770-771.
4. Ostwald visualized energy as one would a substance, such as water, which may exist in more than one state.
5. The translations from German are ours throughout.
6. A. Einstein, "Ist die Trägheit einer Körpers von seinem Energieinheit abhängig?" *Ann. Physik.*, **1905**, 18, 639-41.
7. G. N. Lewis, "The Fundamental Laws of Matter and

- Energy," *Science*, **1909**, 30, 84. Also see G. N. Lewis and M. Randall, *Thermodynamics and Free Energy of Chemical Substances*, McGraw-Hill, New York, 1923, 50, footnotes 1, 2.
8. H. G. Körber and G. Ostwald, *Aus dem wissenschaftlichen Briefwechsel Wilhelm Ostwalds, I. Teil, Briefwechsel mit Ludwig Boltzman, Max Planck, Georg Helm, und Josiah Willard Gibbs, Herausgegeben von Hans-Gunther Körber unter Mitwirkung von Grete Ostwald*, Akademie-Verlag, Berlin, 1961.
 9. The *Zeitschrift für physikalische Chemie* was founded and published by Wilhelm Ostwald and Jacobus Henricus van't Hoff. The journal appeared for awhile as a Leipzig edition (**1959**, 210) and a Frankfurt edition (**1959**, New Series, 19) because of the 1949 partition of Germany. In 1990 the Leipzig version was discontinued and the Frankfurt publication continued
 10. The Connecticut Academy's Transactions were published in only a limited quantity whose number was set to be just sufficient to serve the membership of the academy. Hence, its volumes did not get into the hands of the book-sellers.
 11. The estate left to the Gibbs' children—Josiah Willard, Anna, and Julia—was inventoried in 1870 at \$23,500, which included the equity in the Gibbs' home. To estimate the size of this estate in US dollars of the year 2000, one must take into account the rate of inflation, which is an arbitrary choice based on estimated property values, costs of food, labor, etc. We have chosen an inflation rate of roughly 3% per annum. From the equation $F_n = P(1+r)^n$ where F is the value of one dollar, P is one 1870 dollar and n is (2000 - 1870 = 130), the number of years. This calculation gives a value for F of around 50. Thus the Gibbs' estate would probably be worth about fifty times its 1870 value or about \$1.2 million in U. S. dollars of the year 2000. Another author, using a 2% inflation rate, estimates a P value of 13. We feel the use of a 3% rate of inflation yields a more realistic estimate.
 12. L. P. Wheeler, *Josiah Willard Gibbs, The History of a Great Mind*, Yale University Press, New Haven, CT, 1951, 91. President Gilman of Johns Hopkins made Gibbs an offer of \$3,000 per annum. Yale countered the offer by offering \$2,000.
 13. About ten years had elapsed since the publication of Gibbs' treatises. New developments had occurred that would justify a revised edition.
 14. Bibliographic Citation to Letter No. 88: microfilm, handwritten in German, letterhead printed, *Gibbs Correspondence*, No.15, Yale University Library.
 15. W. R. Longley and R. G. Van Name, *The Collected Works of J. Willard Gibbs, I, Thermodynamics*, Yale University Press, New Haven, CT, 1928; J. W. Gibbs, "On the Equilibrium of Heterogeneous Substances." *Trans. Conn. Acad. Art Sci.*, **1876**, 3, 108-248 and **1878**, 3, 343-524.
 16. Letter No. 89, *Gibbs Correspondence*, No. 151.
 17. C. Hakfoort, "Science Deified: Wilhelm Ostwald's Energeticist World-View and the History of Scientism," *Annals Sci.*, **1992**, 49, 525-544.
 18. Details about Letter No. 90 contain a letter in German by Morris Loeb, a student of Ostwald, to whom he wrote on October 12, 1888, from Newport, RI.
 19. Letter No. 90, *Wilhelm Ostwald Archives*, No. 42/1, Grossbothen, Saxony.
 20. Letter No. 91, *Gibbs Correspondence*, No. 153.
 21. Letter No. 92, *Wilhelm Ostwald Archives*, No. 42/2.
 22. Post Card No. 93, *Wilhelm Ostwald Archives*, No. 42/2.
 23. The establishment and publication of the famous collection, *Ostwalds Klassiker der exakten Wissenschaften*, belongs among the important achievements of W. Ostwald in the field of the organization of science. (See also H. G. Körber, "Einige Gedanken Wilhelm Ostwalds zur Organisation der Wissenschaft," *Forsch. u. Fortschr.* **1957**, 31, 97-103.) Ostwald disclosed some details about the creation of the "Klassiker" in his *Lebenslinien* 2, pp 55-56. His contemporaries approved of the publication of such a collection of authoritative papers.
 24. Letter No. 94, *Gibbs Correspondence*, No. 174a.
 25. Veit & Co. to Gibbs on December 30, 1888; see Letter No.110.
 26. Gibbs gives Ostwald a direct quote from the Veit & Co. letter.
 27. Letter No. 95, *Gibbs Correspondence*, No. 156.
 28. See Veit & Co. letter to Gibbs on March 5, 1889. See Letter No. 113.
 29. Letter No. 96, *Gibbs Correspondence*, No.156.
 30. The three small papers mentioned by Gibbs were "Graphical methods....," "A Method of geometrical representation....," and "On the vapor-densities...". (Refer to Letter No. 112.)
 31. Letter No. 97, *Gibbs Correspondence*, No. 160.
 32. There was an interesting letter from Gibbs to Oliver Lodge dated November 21, 1887, "Electrochemical Thermo-Dynamics," *Report of Brit. Assoc. Adv. Sci.*, **1888**, 58, 343-346, and after that also published as Prof. Willard Gibbs, "Zur elektrochemische Thermodynamik," *Z. physik. Chem.* **1889**, 3, 159-163.
 33. Letter No. 98, *Gibbs Correspondence*, No. 151.
 34. Refer to Letters 110-114.
 35. Ref. 16 (W. R. Longley and R. G. Van Name); J. W. Gibbs, "A Method of Geometrical Representation of Thermodynamical Properties of Substances by Means of Surfaces," *Trans. Conn. Acad. Art Sci.*, **1873**, 2, 382-404.
 36. Letter No. 99, *Wilhelm Ostwald Archives*, No. 42/3.
 37. R. J. Clausius, "On the Behavior of Carbon Dioxide with Respect to Pressure, Volume and Temperature," *Wied. Ann.*, **1880**, 9, 337-357.
 38. J. Clerk-Maxwell, "On the Dynamical Evidence of the Molecular Constitution of Bodies." *Nature* **II**, **1874-1875**) 357-359 (March 4) and 374-377 (March 11). This two-part paper was a lecture delivered at the Chemical

- Society on February 18, .
39. Letter No. 100, *Gibbs Correspondence*, No. 161.
 40. In Letter No. 100 Ostwald suggested that Gibbs expand the text and provide some illustrations.
 41. Letter No.101, *Gibbs Correspondence*, No. 163.
 42. Letter No. 102, *Wilhelm Ostwald Archives* No. 42/4.
 43. Letter No. 103, *Gibbs Correspondence*, No.162; presumably written in September 1891 as an answer to letter No.102.
 44. The German publisher added brackets and dating.
 45. Letter No. 104, *Gibbs Correspondence*, No. 164.
 46. Letter No. 105, *Wilhelm Ostwald Archives*, No. 42/5.
 47. Letter No. 106, *Gibbs Correspondence*, No. 166.
 48. Letter No.107, *Gibbs Correspondence*, No.167.
 49. Letter No. 108, *Wilhelm Ostwald Archives*, No. 42-46.
 50. Letter No. 109, *Wilhelm Ostwald Archives*, No. 42-47.

FUTURE ACS MEETINGS

- March 23-27, **2003**—New Orleans, LA
September 7-11, **2003**—New York, NY
March 28-April 1, **2004**—Anaheim, CA
August 22-26, **2004**—Philadelphia, PA
March 13-17, **2005**—San Diego, CA
August 28-September 1, **2005**—Washington, DC
March 26-30, **2006**—Atlanta, GA
September 10-14, **2006**—San Francisco, CA
March 25-29, **2007**—Chicago, IL
August 19-23, **2007**—Boston, MA
April 6-10, **2008**—San Antonio, TX
August 17-22, **2008**—Philadelphia, PA
March 22-26, **2009**—Salt Lake City, UT
August 16-21, **2009**—Washington, DC
March 21-26, **2010**—San Francisco, CA
August 22-27, **2010**—New York, NY
March 27-31, **2011**—Anaheim, CA
August 28-September 1, **2011**—Chicago, IL
March 25-29, **2012**—San Diego, CA
August 19-23, **2012**—Boston, MA