

Attempts to obtain other similar relations in the spectra of gases have not so far led to any results. If the differences between the frequencies of the fundamental and the higher members of the principal series are taken, we obtain numbers not far distant from the frequencies of the first subordinate series, but this is only a consequence of the facts that the value of  $B$  in Kayser's formula does not vary much, and no importance can be attached to these coincidences, which are only very approximate. A few reflections concerning Kayser and Runge's equation may not be out of place here. The different periods of the same series have every appearance of having the same relation to the fundamental vibration as the overtones have to the fundamental of a sounding body. A word is much wanted to express for molecular vibration what corresponds to an overtone in sound. The term "harmonics" is sometimes used, but is not appropriate, as an overtone may or may not be harmonic to the fundamental. I suggest the expression "over-period." In a sounding body the frequency of the overtones gradually increases without limit, but the overperiods observed in the spectra of elements gradually approach a definite limit, which we have called the convergence frequency. We may imagine a number of particles in a row, and raise the question whether we can imagine some connection between them such that they should be able to vibrate in a series of periods similar to those observed in the spectra of gases. If the particles are detached like those of Reynolds' disconnected pendulums, all overperiods would be equal, and it does not seem impossible to imagine some connection such that for the lower overperiods the connecting forces regulate the frequency, while for the higher overperiods the frequency tends to become equal to that of the separate particles. Looked at from a different point of view we may say that, if we could imagine a rod having elastic properties such that the relation between the velocities of a wave along it and the wave-length is

$$V = a\lambda - b\lambda^3$$

it would, if vibrating freely, give out a number of notes, the relative frequency of which would be the same as that of the luminous vibrations given out by a hydrogen molecule.

ARTHUR SCHUSTER.

#### THE EARLY LIFE OF NANSEN.<sup>1</sup>

THIS volume was compiled at a time when the early confidence in the success of the great Arctic effort had given place in Norway to a feeling of anxiety, if not of alarm. The translation is now published when the preliminary narrative of Nansen's triumphal procession across the polar area has cast his former exploits into the shade, and the expectancy with which the complete account of the expedition is awaited by the public will not be appeased by the book before us. It comes, in fact, a trifle inopportunistly. To modify a wearied metaphor, the play of *Hamlet* is cut short before the central scene; the Scandinavian Prince has just begun to absorb attention when the curtain falls. The book is also heterogeneous in a high degree; no less than six authors are concerned in it, and the fact that all the varied contributions are translated by the same hand, robs them of some of their original freshness, although the translation is really done very well. Perhaps the unifying principle of the ill-arranged chapters may be found in "Peer Gynt," copious quotations from which are scattered over the pages. An abstract of that famous work would have proved no bad substitute for the tedious chapter on the Great Ice-Age, which, even

<sup>1</sup> "Fridtjof Nansen, 1861-1893." By W. C. Brögger and Nordahl Rolfsen. Translated by William Archer. Pp. x + 402. (London: Longmans, Green, and Co., 1896.)

when abridged by the translator, has little to do with the other subjects considered. The chapters on the outfit of the *Fram*, her voyage to the Kara Sea, and Baron Toll's adventurous sledging expedition to the New Siberian Islands, should have been left for the forthcoming work on the polar expedition, a fact which will make them none the less interesting to the general reader. The chapter devoted to an interview with Mrs. Nansen is a clever piece of journalism, but of doubtful taste.

So far as the work is biographical it is welcome and fairly satisfactory. It is natural that the world should wish to know something of the personal life of the men who perform great achievements, and it is proper that this wish should be gratified.

No one has ever met Nansen without being struck by his remarkable personal charm. This happened to be the first fact I knew about him. A friend, who had been spending a holiday in Norway nine years ago, told me, on his return, that what most impressed him there was the appearance and the kindness of a stranger who had shown him the way while lost in the tortuous lanes of Bergen, and who, on saying good-bye, mentioned that his name was Nansen. When Nansen came to this country after the Greenland expedition, the curious magnetism of his presence at once recalled the forgotten remark heard two years before. A similar experience, occurring to many people, is frequently referred to in the biography.

Nansen was not the first Arctic hero of his family, the record of his ancestry beginning appropriately with an account of old Hans Nansen, who, born in 1598, explored the White Sea, and spent many years in command of a vessel in the Iceland trade. He combined literary work with his navigation, and wrote a "Compendium Cosmographicum," wherein he treated of the heavens and the earth, and described Arctic routes so well that a copy of the book was found in use in the year 1841, in preference to more modern sailing directions. More immediate ancestors on both sides were persons of strong character, although their interests and activity lay in other departments; and the authors trace to them, with some skill in the application of the laws of heredity, the blending of poetic and æsthetic feelings with the reckless daring and unalterable determination of Fridtjof Nansen's character.

Born in 1861 at Great Frøen in West Aker, near Christiania, Nansen was not long in showing his love for adventure, carelessness of danger, and disregard of pain. His father, a member of the legal profession, was a stern disciplinarian, but the discipline was judicious and directed to the development of character; his mother was remarkable for her determination and practical resourcefulness; she was also an enthusiastic snow-shoe runner, before that pastime became the common sport for ladies it now is.

Nansen's school-life is briefly traced, and his enthusiasm for athletic exercises and sport of every kind treated more fully and sympathetically, with extracts from his own early letters. Entering the Christiania University in 1880, he decided, after some hesitation, to take up zoology as his special study. Two years later he made his first acquaintance with the Arctic regions during a cruise on the *Viking*, which, while unfortunate from the owner's point of view, was full of opportunities for zoological observations and, above all, for polar-bear hunting on the east of Greenland. The story of this voyage is graphically told from the unpublished diary kept by Nansen. Immediately on his return to Norway, the curatorship of the Bergen Museum was offered to him, and eagerly accepted, as it afforded exceptional opportunities for zoological research. Here Nansen was under the direction of Dr. Danielssen, the founder of the museum, a tireless worker, and a true friend. In his farewell letter in 1893, Nansen wrote:—

"If I should grow weary or slack, the thought of your strength of will and your untiring activity will spur me on as it spurs on many and many another. A thousand good-byes until we meet again."

They never met again; the old enthusiast died in 1894.

While engaged on the study of the sex of *Myxine*, and the nervous system of invertebrates at Bergen, Nansen did not neglect his physical training. A feat scarcely surpassed for actual danger and reckless courage by any of his later Arctic adventures was his crossing of Vosseskavlen on snow-shoes in midwinter. In 1886 there came a visit to Dohrn's Biological Station at Naples; but the strictly biological studies were dropped in the following year, when the plan of crossing the Greenland ice-sheet had been definitely formed. It is not necessary to recount this achievement, the success of which raised Nansen at once to one of the highest places amongst Arctic travellers, brought him a shower of distinctions, and prepared the way for the triumph of his Arctic drift.

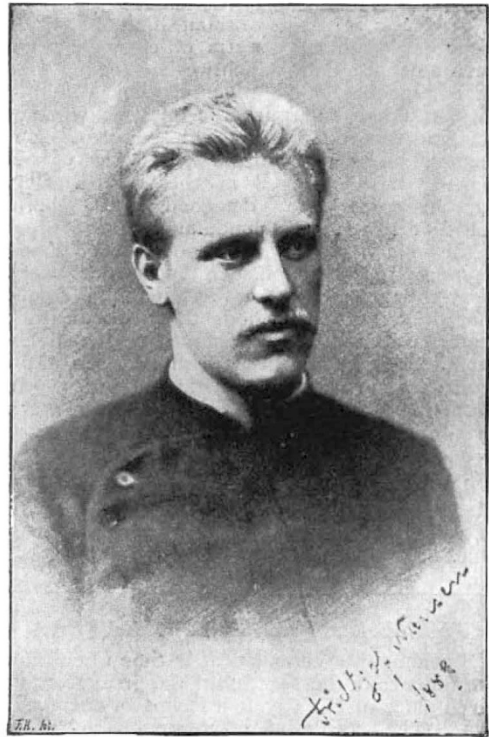


Hans Nansen.

That Nansen has found his sphere in the work of polar exploration is undoubted. By race, ancestry, and upbringing, adventurous travel was his inevitable destiny, and success was assured by a combination of qualities which are rarely found together. His marvellous physique comes first, making him as nearly impregnable to cold, fatigue and hunger as ever man was; then his equally remarkable determination and daring, qualities of mind which urged his physical powers to the uttermost, and made retreat from any path once entered upon an impossibility. His friends knew that if Fridtjof Nansen did not return successful from any quest, he would never return at all. The principle which most shocked previous Arctic explorers was his rule of providing no means of retreat, in fact of making retreat impossible—the principle of *Fram*. These qualities of body and mind are frequently combined in "record-breakers" of every kind; their combination may result in a champion prize-fighter, a professional football player, a 30-mile-an-hour cyclist, a peak-conquering mountaineer; they

ensure, in fact, merely a forced-draught motive power. The third element is that of training, the educational discipline of home and school succeeded by the scientific discipline of the university and the laboratory. This gave direction and controlling power to the fervid energy; but the capital importance of this fact has not been adequately set forth in the biography. It may have been recognised by the authors, but it has been obscured by a quite unnecessary mass of irrelevant matter. A case like this is a splendid proof of the superiority of scientific education over any merely classical teaching in developing the whole power of a man.

We believe that Nansen owed his success in both his great journeys to the fact that he could himself study the conditions he had to meet, and plan his method of meeting them; that having studied and formed his plans himself, he could also carry them out himself with the aid of a few devoted companions. The contrast of the expeditions planned by a large Committee, and executed



Fridtjof Nansen.

by a large crew under orders they cannot deviate from, is quite apparent. The plan suggested for obviating railway accidents, by mounting a director in front of the engine, was that which Nansen adopted. He was ready to stake his life on the accuracy of his methods; and if his biological studies did not settle the problems of the nervous system, or even of the haggish, they certainly disciplined his powers of observation and of reasoning, and so enabled him to succeed and to excel in his chosen career.

A few slips in translating or printing may be pointed out. On p. 80 we read, "He pursues the paltriest insect revealed by the microscope, no less impetuously than he pursued the bears over the Arctic wastes." Here *insect* stands apparently for the fine old *animalcule*, although *paltriest* is even in that case a curious word to use with reference to an object of biological research. On p. 119, "the English zoologist G. P. Cunningham" should, of course, be J. T. Cunningham. In comparing the cold of the Greenland Ice-cap with that of Northern Siberia

the very important correction to sea-level is apparently left out of account (p. 205), but the passage is not clear. It was the younger, not the elder, Ross (p. 241) who conducted the successful Antarctic expedition. The historic drift of the *Hansa* in the ice was not "from Smith Sound right down to Davis Strait" (p. 281), but, as correctly given at two other places in the book, along the east coast of Greenland. The "geographical congress which lasted a week" (p. 289) at Newcastle in 1889, was the British Association, Section E of which was addressed by Nansen. On p. 291 the remarkable statement that Dr. Nansen was presented by the Royal Geographical Society with "the patrons of the Victoria medal," is resolved, on reference to the authority cited, into "the Patron's or Victoria Medal."

We miss any statement in the preface as to whether Dr. Nansen gave his approval to the publication of this translation of a work which was compiled in his absence, from data which must have been very incomplete. We are reluctant to suppose that his friends would, without his express sanction, have published so much of a purely personal and, sometimes, of a private nature, and the suspicion that they may have done so should have been made impossible.

HUGH ROBERT MILL.

#### CELEBRATION OF PROF. CANNIZZARO'S JUBILEE.

WITH an impressiveness worthy of the high scientific value of the man who was honoured, the seventieth birthday of Prof. Stanislao Cannizzaro was celebrated on November 21 in Rome. In the wide amphitheatre of the Chemical Institute of the Royal University, in the same place where the illustrious investigator's activity was continually shown, many of the highest and most distinguished persons of the Eternal City met to do honour to him. Colleagues, friends, pupils collected to pay to this renowned chemist their tributes of esteem, veneration and affection, and in these feelings the whole scientific world joined.

No company more distinguished ever sat in those school benches. There were Senators Cremona, Tomasi-Crudeli, Todaro, Blaserna, ex-Minister Bacelli, Profs. Beltrami, Grassi (Darwin Medallist), Strüver, Luciani, Cerruti, Helbig, Bovio, Prof. W. Longuinine of Moscow, and many others.

When, accompanied by the President of the Council, Marquis Di Rudini, by the Under-Secretaries of State, Hon. Galimberti and Arcoleo, by the Prefect Count Bonasi, and the Rector Magnificus, Prof. Semeraro Cannizzaro entered the hall, the audience burst into long and loud applause.

Prof. Senator Paternò opened the proceedings by saying that the Committee spontaneously formed among Prof. Cannizzaro's students has been obliged to confine itself to a few things, not for want of means, as many offers were sent from various parts of the world, but on account of the desire of Cannizzaro himself. Prof. Paternò presented a gold medal of admirable workmanship, which at one side holds in relief Cannizzaro's imagine, and at the other the following inscription: "To Stanislao Cannizzaro scholars and admirers, on the occasion of his seventieth birthday." He presented also an artistic bust of Cannizzaro in bronze from one of his English admirers, and numerous pergamenas, addresses, letters, telegrams, sent by the most important scientific Societies of the world. An address was sent by the Royal Society of London; and the Faculty of Science in the University of Heidelberg sent a pergamena in Latin. Among the bodies which sent letters of congratulation were the "Académie des Sciences de Belgique," the Italian "Accademia dei Quaranta," and the Academies of Turin,

Naples, Bologna, Venice, Milan, Catania. The Academy of St. Petersburg sent the following telegram.

"L'académie impériale des sciences rempli de considération pour les travaux de l'illustre savant participe aux vœux et félicitations unanimes à l'occasion de son jubilé.

"Le secrétaire perpétuel,  
"General Lieutenant Doubrovine."

Among the foreign Chemical Societies, those of London, Berlin, St. Petersburg, the American Chemical Society sent addresses:

Congratulatory letters and telegrams were also received from the Société chimique de Paris, Bucarest, Heidelberg, Munich, from the *Verein Deutscher Chemiker*, from the Chemical Society of Finland, the Badische Anilin und Sodafabrik, the Chemical Laboratories of Tübingen, Bucarest, Lisbon, and from all the Italian Universities. The Chemical Society of Aix-le-Chapelle sent a pergamena.

Among the most eminent persons who sent their best wishes to Cannizzaro, we take notice of the following: Lieben, Baeyer, V. Meyer, Mallet, Alnovillicus (Erlenmeyer, sen), Curtius, Wislicenus, Hantzsch, Fittig, &c., General Annibale Ferrero, Italian Ambassador at London, Ministers Guicciardini and Codronchi, Prof. Cosfa (Turin), Prof. Ugo Schiff (Florence), &c. The University of Kasan have made Cannizzaro Honorary Professor on this occasion; and the Grand-Duke of Baden conferred on him the "Komandeurkreuz 1<sup>o</sup> Klasse des Zähringer-Löwes."

Prof. Semeraro, Rector Magnificus of the Roman University, delivered the following address:—

"This festival does not only belong to the University of Rome, but also to the world's science. Cannizzaro's work is to be considered as having two parts, the one dear to the world, the other dear to us. We have seen the former in the addresses, letters, telegrams sent on this occasion; the latter is to be found in his teaching career, which is nearer to his heart.

"When Cannizzaro received the Copley Medal, the celebrated man said, he has been but a teacher, he had but loved the school and his pupils. My science, said he, has been the aim of my life for their instruction and warfare.

"His greatest glory lies in the fact that most of the professors now teaching in Italian Universities have been his scholars. The pressure of business, as Vice-President of the Senate, and Member of the Superior Council of Public Instruction, and many others, never were pretexts to him for overlooking the modest duty of a teacher. That is what makes him glorious in our University.

"Since Cannizzaro was admitted in Senate for his own scientific merits, he has never rested. He acquired from the Government the means for studying, and creating the first great Italian chemical school, and we all have seen what a happy success he has obtained by these means.

"To-day we can say on Cannizzaro what is said in an ancient inscription of a great Roman church, '*Virtute vivit, fama vivit, gloria vivet.*'"

In presenting to Cannizzaro the Grand Cordon of the Crown of Italy, Hon. Galimberti, Under-Secretary at the Public Institution Office, said:—

"This adds nothing to your fame, but is a proof that your own Government joins with those around you in their congratulations. People could give you this decoration with greater title, but none with greater affection and devotion than I do. Your name, as the Royal Society of London has said, is worthy of being joined with those of Galileo, Torricelli, Volta, and Galvani. To Emanuel Kant, who, in his absolute sentence, considered chemistry as a union of empirical knowledge, you replied half a century ago, pronouncing among the