

perfectly in a position to show that the rudest forms of the most developed language have sprung, by insensible derivation, from phonetic signs as vague, simple, and monosyllabic as those of Chinese itself. These signs left the mutual *relations* of ideas unexpressed. There were at first no special vocal expressions, no *organs* for the fulfilment of grammatical functions, or the interdistinction of nouns and verbs, much less of conjugation or declension. Such words as *That, gethan, Thuer, Thäter, thätig*, all point back to a root *dha*, which contained in itself the undeveloped germ of all sorts of verbal, nominal, and adverbial modifications. And in this respect the ultimate roots of the Aryan languages closely resemble in character the actual words of those languages which have remained to this day as nearly as possible in their primitive condition. Such roots may without fancy be called speech-cells, in which the rudiments of all special organs are implicitly *involved*, but in which they are as little *developed* as in the germinal vesicles which represent the earliest forms of animal and vegetable life. There may have been multitudes of such sound-cells, as it were, from which different families of language have sprung by special lines of development; just as, according to the Darwinian hypothesis, many primordial cells, presenting a close similarity, may have been the earliest rudiments of all living organisms.

In speaking of the extinction of species and the struggle for existence, Mr. Darwin uses language which may be literally applied—applied without even verbal modification—to the phenomena of languages. Here, no less than in the animal and vegetable kingdom, the dominant forms of the prevailing groups tend to leave many modified descendants, while the imperfection of the weaker groups leads to their gradual disappearance. But the complete extinction of a linguistic type is a slow process, and just as extinct animal forms may leave behind them a few decaying representatives in inaccessible or solitary places, so in the mountain-valleys of the Pyrenees and the Caucasus, we find isolated dialects which may be the fragmentary relics of tongues once spoken in immense districts. But a language once extinct, like an extinct species, can never under any circumstances reappear; and its place is occupied by the nearly related but greatly modified groups of predominant families, which are precisely those which undergo the completest differentiation in the course of their gradual victory over less happily constituted forms. And in consequence of the extinction of languages many *intermediate* forms have perished; the primitive relationships of languages have been disturbed by all sorts of external influences, and consequently languages radically different are now found existing side by side. All this, as every naturalist is well aware, represents a condition of things precisely similar to that which prevails in animated nature.

Mr. Darwin, in his great work, devotes a few words to the classification of languages as affording a confirmation of his theories. It does so to an extent of which probably he was not at first aware. In two capital points, viz., (1), the immense changes which can be effected by infinitesimally gradual modification; and (2) the preservation of the best and strongest form in the struggle for life, Mr. Darwin's hypothesis may be confirmed and verified

by the entirely independent researches of the comparative philologist. These are the two points to which Prof. Schleicher wished to draw attention in the pamphlet which I have here epitomised. They do not indeed represent the whole of the linguistic facts which might be adduced on this side of the question, and they leave out of sight others which might be alleged with great force in favour of an opposite view. Some of these I have endeavoured to set forth elsewhere,* and possibly there may be some future opportunity of again bringing this subject before the reader. My present object was to make the views of Prof. Schleicher more widely known than they have yet become among English naturalists and scholars.

F. W. FARRAR.

THE PRIVATE LIFE OF GALILEO

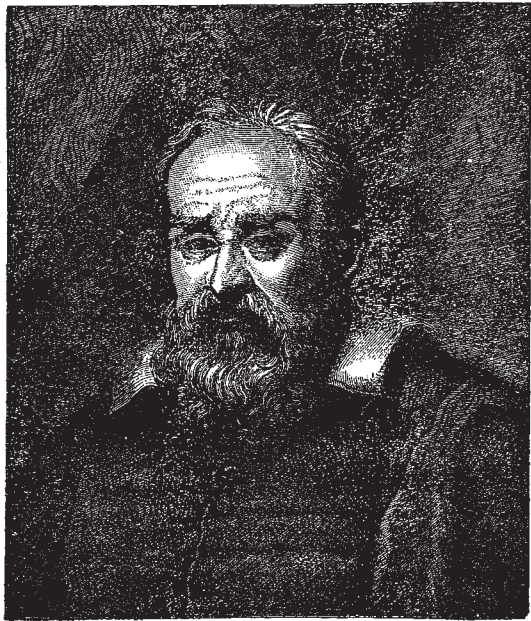
The Private Life of Galileo. Compiled principally from his correspondence and that of his eldest daughter, Sister Maria Celeste, nun in the Franciscan convent of S. Matthew at Arcetri. 307 pp. (London: Macmillan and Co. 1870.)

THE numerous works which have appeared with Galileo for their theme may be divided into three classes. Firstly, those which relate more particularly to his persecution by the Church, the position and influence of the Sacred College in his day, and its attitude towards science. Secondly, those which treat of his scientific labours apart from himself, their nature and character, and their influence on the propagation of truth, the advancement of modern philosophy, and the downfall of Aristotelianism. Thirdly, those which discuss his private life. The first and last of these are often blended, more or less, and of necessity, but we know too little of his scientific labours. M. Parechappe has well remarked, "*Le savant s'est effacé dans le martyr.*" The works of Galileo, if much talked of, are certainly little read—"Il Saggiatore" and the "Dialoghi" are even less read than the "De Augmentis Scientiarum" and the "Novum Organum;" while the "Principia" of Descartes occupies a position of notoriety midway, perhaps, between "Il Saggiatore" and the "Novum Organum," and we have a little difficulty in placing the writings of Hobbes. Yet it is undeniable that the works of these four men have produced a more profound and permanent influence upon human thought than any which preceded them. There is but one epoch in the history of the world to be compared with their epoch; it is that of Aristotle.

The work before us belongs both to the first and third of the above divisions, it relates mainly to the private life of Galileo, and resembles Arduini's "*Primogenita di Galileo Galilei*," more than any other work on the subject. The account of the private life of Galileo, unlike many such accounts, does not give us much insight into the manners and customs and conditions of society at the time of which it treats, both because Galileo had so little real domestic life, and because the main correspondence which furnishes these private details took place between a nun (who of all persons can know least of the external world) and Galileo himself, and her letters to him have been preserved, while his answers to them have perished. Your great philosopher as a rule is exceedingly

* See a paper on "The Growth and Development of Language" in the *Cambridge Journal of Philology*.

undomestic, and the proofs of this are so common that we need not quote a single example; the petty details of home weary them, and prevent the abstraction requisite for their labours: so the ancient Brahmans, who reasoned as profoundly as any light of Western civilisation, lived in the solitudes of the forests of Ancient India; so Descartes withdrew himself from the world, and remained



GALILEO

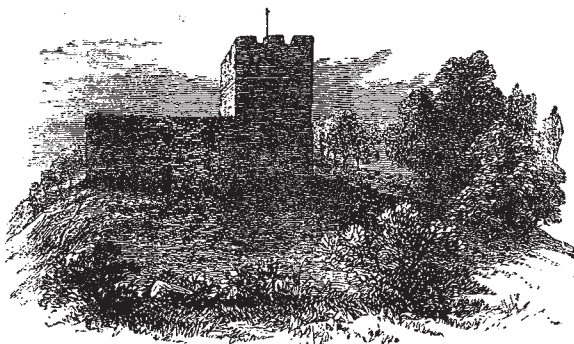
(From Ramsey's picture in Trinity College, Cambridge)

buried in the quiet of his country house while he produced his "Meditations."

Galileo also was by no means domestic. Of his three natural children, his son Vincenzo was a constant thorn in his side. He was a lazy fellow, who was always writing to his father for money, and who, Italian-like, preferred to idle away his life in singing and lute-playing, to adopting any profession or attempting to get his own livelihood. We cannot find one good quality in Vincenzo Galileo; he was mean, selfish, inconsiderate and unnatural in his behaviour towards his father. One example of this is sufficient. He had quartered himself on his father, together with his wife and children, when the plague broke out in the neighbourhood; whereupon Vincenzo deserted the old man, and went to a more healthy locality, leaving his father to take his chance with the other inhabitants of the district. Galileo's daughters Polissena and Virginia were placed in the Convent of S. Matthew, at Arcetri, in 1614, when the eldest was only thirteen years old; henceforth they became Sister Maria Celeste and Sister Arcangela. Of the latter we hear but little, but Sister Maria Celeste constantly corresponded with her father, and the greater number of her letters have been preserved, and are now in the Palatine Library at Florence. These letters contain some interesting details of convent life of the period, but of necessity they do not bear upon many of the doings of the outside world; their general tenor is the same throughout; they are full of her love for Heaven

and for her "dear lord and father," as she was wont to call Galileo, and they almost invariably pass to an opposite extreme of matters exceedingly of the earth, earthy—the baking of cakes, the mending of linen, the getting up of his collars and so on. She tells her father all the minute details of her work, as: "I have been extremely busy at the dinner-napkins. They are nearly finished; but now I come to putting on the fringe, I find that of the sort I send as a pattern a piece is wanting for two dinner-napkins: that will be four *braccia*." The last paragraph of this desultory letter begins, "These few cakes I send are some I made a few days ago, intending to give them to you when you come to bid us adieu;" and ends, "I thank Him for everything, and pray that He will give you the highest and best felicity;" and a postscript immediately follows this—"You can send us any collars that want getting up."

Galileo's villa was very near the convent, and a constant interchange of courtesy seems to have taken place; Galileo sent money and presents of meat and wine, while Sister Maria Celeste sent him plums, and baked pears, and candied fruits, and cakes, and mended his linen and kept his wardrobe in order. Her love for him amounted almost to worship, at least to veneration. When at length, worn out by watching in the convent infirmary, by ill health, and by the many privations inseparable from a convent life, she felt her end approaching, Galileo was in confinement at Siena, and she feared she should see him no more; but he was allowed to retire to his own house, and arrived at Arcetri in time to see his daughter before her death. Writing of this time (1634), Galileo says: "Here I lived on very quietly, frequently paying visits to the neighbouring convent, where I had two daughters who were nuns, and whom I loved dearly; but the eldest in particular, who was a woman of exquisite mind, singular goodness, and most heartily attached to me."



GALILEO'S TOWER

There is much in this "Private Life of Galileo" of great interest in connection with his scientific work, his books, his persecutions and trial by the Sacred College, and his condemnation; but we have preferred to keep strictly to his more private life, as the theme is so large, that if we once touched upon his scientific work and its results, we should require far more space than could be placed at our disposal here.

Galileo continued actively employed to within a few years of his death, in January 1642. During his latter years he was a great sufferer. "I have been in my bed

for five weeks," he writes to Diodati, in 1637, "oppressed with weakness and other infirmities, from which my age, seventy-four years, permits me not to hope release. Added to this, *proh dolor!* the sight of my right eye, that eye whose labours (I dare say it) have had such glorious results, is for ever lost. That of the left, which was and is imperfect, is rendered null by a continual weeping." Thus the poor old man complained, until finding that his blindness was incurable, and that his many ills were increasing, he ceased repining, and begged his friends to remember him in their prayers, till his unhappy chequered life was closed by death.

G. FARRER RODWELL.

OUR BOOK SHELF

Reptiles and Birds. A Popular Account of their various Orders, with a Description of the Habits and Economy of the most interesting. By Louis Figuier. Illustrated with 307 woodcuts. Edited and adapted by Parker Gillmore. 1870. (London: Chapman and Hall.)

A VERY pretty book for a drawing-room table. The description of the several families of both reptiles and birds is filled with anecdotes culled from all sorts of writers, some of them sufficiently amusing, others, to say the least, of doubtful accuracy; witness the following in reference to the stork:—"The inhabitants of Smyrna, who know how far the males carry their feelings of conjugal honour, make these birds the subject of rather a cruel amusement. They divert themselves by placing hen's eggs in the nest of the stork. At the sight of this unusual production the male allows a terrible suspicion to gnaw his heart. By the help of his imagination he soon persuades himself that his mate has betrayed him; in spite of the protestations of the poor thing he delivers her over to the other storks who are drawn together by his cries, and the innocent and unfortunate victim is pecked to pieces." We should like to see this cruel amusement played out once to the bitter end, and should then, but not till then, believe it.

The drawings and woodcuts are as excellent as they are numerous.

Beiträge zur Lehre von den Functionen der Nerven-centren des Frosches. "Essays on the Functions of the Nerve-centres in the Frog." By Prof. D. Fried. Goltz, of Königsberg. pp. 130. (Berlin, Hirschwald, 1869.)

THIS little brochure, which, though small, contains the result of much work, is divided into four sections. 1. On the reflectorial excitation of the voice in frogs. 2. On the physiology of generation in the frog. 3. On the inhibitory influence which can be exerted on the reflex actions; and 4. On the seat of the mind (Seele) in frogs; beside investigations on the centre for the maintenance of equipoise, and the centre for locomotion. It may be observed that notwithstanding the experiments were all undertaken in frogs, those little martyrs to science, yet that some of the results at least have a direct bearing on the functions of the centra in the higher animals, and even on man himself. The results of his experiments in reference to the seat of the mind are at variance with those of Pfüger and others, who hold that the spinal cord participates with the brain in its possession. M. Goltz maintains, on the contrary, that the brain is the *exclusive* seat of all intellectual processes, and consequently, that a frog from which the whole encephalon has been removed, is an organism presenting only a complex series of reflex processes. The removal of the *cerebrum* alone deprives the animal of all voluntary movement, and of all those

faculties which are included under the general head of consciousness; it still retains, however, certain powers of co-ordination. If the corpora quadrigemina are then removed, it no longer possesses the power of preserving the equipoise of its body or the accommodation of its movements. The corpora quadrigemina therefore, he concludes, constitute the centre for the maintenance of the equilibrium of the body. The cerebellum, on the other hand, is the centre for locomotion of the whole body.

Schriften der Naturforschenden Gesellschaft in Danzig
Neue Folge, Zweiten Bandes, Zweite Heft, 1869.

THE Danzig Natural History Society publishes annually a part of its Transactions, which, although but little known in this country, often contain valuable papers. In the part for 1869, which we have just received, we find an elaborate memoir by Dr. Bail, on the epizootic fungi which affect the caterpillars injurious to forests, and it is some comfort to think, that while these vegetable parasites do nothing but mischief among the silk establishments of the south of Europe, they are regarded as serviceable in other quarters. This part also contains the continuation of M. A. Menge's valuable monograph of the Prussian spiders, of which the author has now described and figured 157 species. This memoir is indispensable to the archæologist, and is in itself a wonderful result of the most minute research—research so minute, in fact, that the author is unfortunately led to magnify the importance of slight differences, and thus to establish a great number of new genera upon very slight grounds. M. Menge also describes and figures a species of scorpion and two species of spiders from amber; each of the latter forms the type of a new genus. Dr. Bail contributes a short but interesting paper on the occurrence of androgynous flowers in monœcious and diœcious plants. Besides some minor communications on subjects connected with natural history, the part contains two memoirs which one would hardly expect to find in the Transactions of a society of naturalists, namely, a description of the construction and theory of a marine distance-measurer, and an investigation of the moon with reference to its ellipsoidal form, by M. E. Kayser, who describes himself as "Astronomer to the Natural History Society of Danzig." The former of these papers is illustrated with three folding plates.

Notes on Microscopic Crystals included in some Minerals.

By Isaac Lea. From the Proceedings of the Academy of Natural Sciences of Philadelphia. Read February 16 and May 11, 1869.

IN these two papers the author gives an account of the minute crystals included in sapphire, garnets, and several other minerals, which in some cases are arranged in a number of definite planes, so as to give rise to the appearance seen in the so-called "star sapphires." The essays are illustrated by a plate, which shows the character of the crystals in a very satisfactory manner. The author is, however, not quite correct in thinking that such included crystals had not been previously described by several authors. Söchting, in his excellent work,* gives an account of some facts similar to those observed by Mr. Lea; and Messrs. Sorby and Butler, in their paper on the microscopical structure of rubies, sapphires, &c.† describe "the small plate-like crystals, often triangular in form, with an angle very acute. They are very thin, and arranged parallel to three principal planes of the sapphire," and are thus precisely like those now figured by Mr. Lea. There can be no doubt that the study of the minute crystals included in minerals often throws much light on their origin, and they play a far more important part than is often supposed, and serve to explain some of the discrepancies met with in their chemical composition.

* Einschlüsse von Mineralen u. s. w. Freiberg, 1860.

† Proceedings of the Royal Society, vol. xvii., p. 291.