

made in the art of gold extraction. So far as possible, account has been taken of all important processes in bringing the book up to date.—Dr. David Walsh's volume on "The Röntgen Rays in Medical Work" (Baillière, Tindall, and Cox) contains much information of interest to all who desire to know how far Röntgen rays have been utilised in medical and surgical cases. To the physician and surgeon this second edition should be of great service in showing what has been done. Referring to the progress made since the publication of the first edition, Dr. Walsh says: "In practical work the times of exposure are shorter, results more certain, and the merits of the static machine more widely recognised."—A second edition of "A Text-book of Applied Mechanics," by Prof. Andrew Jamieson, has been published by Messrs. Charles Griffin and Co., Ltd. This book has been revised and extended, the chief additions being in the part on hydraulics and hydraulic machines.—The case for cremation as a means of disposing of the dead is forcibly stated by Sir H. Thompson in "Modern Cremation" (Smith, Elder, and Co.), the third edition of which, revised and much enlarged, has just been published. The volume brings up to the present date the history of the practice of cremation, and of the work of the Cremation Society of England.

THE additions to the Zoological Society's Gardens during the past week include a Tantalus Monkey (*Cercopithecus tantalus*) from West Africa, presented by Mr. W. Knight; two Hairy Armadillos (*Dasyurus villosus*), a Geoffroy's Cat (*Felis geoffroyi*) from La Plata, presented by Mr. W. Brown; a Magpie (*Pica rustica*), British, presented by Mr. S. B. Goldsmith; a Red-eared Bulbul (*Pycnonotus jocosus*), a Yellow-bellied Liothrix (*Liothrix luteus*) from India, presented by Miss Petrocochino; two Goshawks (*Astur palumbarius*), European, presented by M. P. A. Pichot; three Spotted Tinamous (*Northura maculosa*) from Buenos Ayres, four Rufous Tinamous (*Rhynchotus rufescens*) from Brazil, presented by Mr. Ernest Gibson; two Black-eared Marmosets (*Hapale penicillata*) from South-east Brazil, two Maholi Galagos (*Galago maholi*) from South Africa, a Sooty Phalanger (*Trichosaurus fuliginosus*) from Tasmania, a Malabar Squirrel (*Sciurus maximus*, var. *dealbatus*) from India, a Long-necked Chelodine (*Chelodina longicollis*) from South Australia, two Serrated Terrapins (*Chrysemys scripta*) from North America, deposited; a Grison (*Galictis vittata*) from South America, two Superb Tanagers (*Calliste fastuosa*), a Blue and Black Tanager (*Tanagraella cyanomelaena*) from Brazil, a Thick-billed Tanager (*Euphonia lanirostris*) from Central America, purchased; a Common Mynah (*Acridotheres tristis*) from India, received in exchange.

#### OUR ASTRONOMICAL COLUMN.

HOLMES' COMET, 1899 *d* (1892 III.).—A new ephemeris for this comet is given by Mr. H. J. Zwiers in *Astr. Nach.* (Bd. 150, No. 3582). It is important that as many observations as possible should be secured, in order to provide the necessary data for a more correct determination of the orbit.

#### Ephemeris for 12h. Greenwich Mean Time.

1899.	h.	m.	R.A.	Decl.	Br.	( $r\Delta$ )-2.
Aug. 10	...	2	43 48'80	..	34 39 46"4	
11	...	44	56'27	...	34 55 39"6	
12	...	46	2'64	...	35 11 29"8	... 0'1940 ... 0'04674
13	...	47	7'89	..	35 27 16"9	
14	...	48	11'99	...	35 43 0"9	
15	...	49	14'92	...	35 58 41"7	
16	...	50	16'66	...	36 14 19"2	... 0'1923 ... 0'04781
17	...	2	51 17'17	...	36 29 53"4	

COMET SWIFT (1899 *a*).—Observers still interested in this comet, and possessed of the necessary optical means, will find an extended ephemeris in the *Astr. Nach.* (Bd. 150, No. 3583)

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by Herr J. Möller, of Kiel. The positions and relative brightness are given up to September 16, but it is only with the largest instruments that the comet can be at all detected.

THE NEW ALGOL VARIABLE.—In *Harvard College Observatory Circular*, No. 44, Prof. E. C. Pickering gives an ephemeris for observations of this recently discovered variable. The following are the predicted minima during the nights of the present month:—

#### Heliocentric Minima of B.D. 45°3062.

1899, August 11, at 11h. 43m.

" " " 20, at 15h. 12m.

The position of the star is

R.A. ... 20h. 2'4m. } (1855),  
Decl. ... + 45° 53' }

and its normal magnitude about 8.6.

DOUBLE STAR CATALOGUE.—Mr. R. G. Aitken has communicated to the *Astr. Nach.* (Bd. 150, Nos. 3584-5) his observations of 319 double stars made during the year 1898. The measures were made with the filar micrometer, in conjunction with either the 12-inch or 36-inch refractor, at the Lick Observatory. The star places are all reduced to epoch 1900, and the data given are time of observation, position angle, distance of components, and their individual magnitudes.

ELEMENTS OF COMETARY ORBITS.—M. G. Fayet has extended Oppolzer's "Traité des Orbites," and brought it up to date by giving the approximate elements for the year 1900 of all the comets hitherto observed. The list is divided into three portions, dealing with comets having elliptic, parabolic, and uncertain orbits respectively; 106 comets are given with elliptic elements, and 104 with parabolic elements, the dates of observation extending from 1702 to the present time. Fifty-one comets of uncertain elements are given, extending from 137 B.C. to 1880. This list of cometary elements will be especially useful in referring to the elements of any new comet, to see if it is really a new member of the solar system or a return of one previously recorded.

#### THE FUR-SEAL HERDS OF THE NORTH PACIFIC.

FEW commercial industries command a more varied or more widely spread series of interests than does the sealing trade of the North Pacific. In addition to the great biological interest attaching to the seal-herds, we have, first of all, a considerable number of Aleuts dwelling on the islands to drive, kill, and skin the seals, and who subsist to a certain extent on seal-flesh. Then there is the revenue drawn by the American and Russian Governments for the right of sealing on their respective islands, as well as the Customs dues levied by the former on the dressed seal-skins when re-imported into their territory. Not to mention the transport of the raw hides, the dressing of the latter and their conversion into commercial seal-skin forms a very important industry in London, which employs a large number of hands. There are, moreover, the vessels and their crews, which have of late years been engaged in pelagic sealing; a large proportion of which sailed from Canadian ports. Finally, there is the manufacture of the finished seal-skin into garments, and the retail sale of the latter.

From all points of view a cordial welcome should, therefore, be extended to the issue by the United States Government of the official Report of the Commissioner in charge of the fur-seal investigations of 1896-97. This Report, which bears the title of "The Fur-Seals and Fur-Seal Islands of the North Pacific Ocean," is in two parts, and comprises the final results of the investigations carried on by the Commissioner and his associates, as well as the recommendations jointly formulated by the American and British members of the International Commission.

The fur-seals of the Northern Pacific comprise three distinct herds, which are stated to keep strictly apart from one another, having each their own breeding-places, feeding-grounds, and routes of migration. The most important of the three herds is the one resorting for breeding purposes in summer to the islands of St. Paul and St. George in the Pribyloff group, situated on the eastern side of Bering Sea. In winter this herd

passes through the channels of the Aleutian chain into the Pacific, ranging as far south as Southern California, and returning to their summer haunts along the American coast. Next in importance is the Komandorski herd, the members of which breed upon Bering and Medui islands in that group, migrating in winter down the eastern coast of Japan, and returning by the same route the following summer. Smallest of all is the Robben Island herd, now restricted to Robben, or Tiuleni Island, in the Sea of Okhotsk, just south of Saghalien, but which formerly also colonised four islands of the Kurile chain. The line of migration of this herd lies through the Sea of Japan, so that it never enters the open Pacific. Whereas the Pribyloff herd, which is the one to which the present Report, so far as published,<sup>1</sup> mainly refers, is the property of the Government of the United States, the other two belong to Russia. So far as can be ascertained, the Komandorski and Pribyloff herds were unknown to man (except during migration) till the discovery of the former islands by Bering in 1741, and of the latter by Pribyloff in 1786.

Hitherto the seals of all three herds have been regarded as constituting a single species, *Otaria* (or *Callorhinus*) *ursina*, although differences in colour, shape, and the character of the fur have long been known to exist between them. From the complete isolation of the three herds, and the apparent absence of intermediate forms, Dr. Jordan, the American Commissioner, feels justified in regarding them as indicating as many distinct species, the leading characteristics of which are indicated in the Report. The typical *ursina* is represented by the Komandorski herd, while to the Pribyloff form is assigned the name *alascana* (*alascanus* if *Callorhinus* be recognised as a genus) and to the Robben Island seals that of *curilensis*. To our own thinking it would have been better if these three forms had been regarded as subspecies, and that such a classification at one time occurred to Dr. Jordan, seems to be indicated by the circumstance that the page (45) of the Report on which they are described is headed "The Subspecies of Fur-Seal."

The fact that the fur-seals resort every summer in great numbers to the Pribyloffs for breeding purposes is doubtless well known to the great majority of our readers, but as some new facts in regard to their period of residence on the islands and their habits while there are recorded in the Report, a brief sketch of this period of their existence may not be out of place.

The old breeding "bulls" are the first to put in an appearance, their average date of landing being about the first of May. The younger bulls do not land till the arrival of the "cows," when they "haul out" and pass round the "rookeries" to places in the rear, or fight their way through the territories of the old bulls in possession. The "bachelors," or immature males, begin to arrive about the same time as the old bulls, usually making their appearance according to age; the smaller seals beginning to predominate after July 9. The older bachelors being alone killed in the Pribyloffs, as many as possible are slaughtered before the arrival of their younger brethren, regular driving usually commencing about June 1. It is about June 10 that the adult cows begin to arrive, their appearance and landing, like that of the adult bulls, being gradual. Their arrival is not, as has been stated to be the case, an occasion of fighting among the old bulls for their possession. As a rule, a female about to land reconnoitres the shore by swimming backwards and forwards, and then lands on the rocks, where she is immediately taken in charge by the nearest bull. If a bull discovers her while attempting to land, she endeavours to escape; but if this is impracticable, she submits and takes her station on shore beside him. When a bull once obtains a cow, his station becomes an objective point for all the others landing in the vicinity, and a "harem" is thus formed; large "harems" being thus constituted in the neighbourhood of favourite landing-places. Soon after landing the cows give birth to their "pups" (one in number to each cow).

In the larger rookeries as many as a hundred cows may go to the formation of a single harem; and so long as they remain quietly resting before and after the birth of their pups, the one bull has no difficulty in keeping them under control. But as soon as the pairing-season sets in (which it does very soon after the birth of the pups) the old bull is unable to manage his harem, and the "idle bulls" around enter the circle. With the "podding" (collection in masses) and scattering of the pups and the influx of fresh cows, the area occupied by the

seals gradually extends, and fresh bulls are taken into the circle, until the utmost limits of expansion are reached.

The population of breeding cows gradually increases from the beginning of the season till about the middle of July, from which period it diminishes till the close of the breeding-season, about August 1, the height of the season being about July 15, when the maximum number of breeding cows are on shore. It is not, however, to be assumed that by any means all the cows are then on land—quite the contrary. From about June 10 or 12 onwards fresh cows are constantly arriving at the rookeries, each cow making a sojourn of about ten or twelve days, after which she starts on her first excursion to the feeding-grounds, distant between one and two hundred miles. The height of the season accordingly means merely that the stream of arriving cows is about counterbalanced by the departing one.

Throughout the breeding-season a band of sleeping, playing, and swimming seals skirts the sea-front of each rookery, the majority of these being cows, although some are bachelors. This band includes the arriving and departing cows; the former gradually edging themselves nearer and nearer to the shore, while the latter tend to the seaward fringe. So stealthily is the landing and the departure accomplished, that it is a very difficult matter to observe a cow either in the act of landing or of setting out to sea. One reason of the loitering before landing seems to be to allow time for the complete digestion of the food, which always takes place while at sea. As the bachelors likewise make periodical journeys to the feeding-grounds, it is evident that it is only the bulls which fast throughout the breeding-season; and for the purpose of enduring this, they accumulate a thick layer of blubber previous to landing.

On landing from one of her feeding expeditions the cow calls lustily for her pup, on finding which she forthwith proceeds to nurse it, the pup then departing and taking no further notice of its parent till it again requires a meal. As the majority of the cows are at sea, a landing cow is immediately surrounded by hungry, and it may be starving, pups, who are driven away with decidedly savage treatment. The pups are entirely dependent upon their own mother's milk till about November, the Commission scouting the idea that there is any promiscuous feeding of the pups by the cows, or that the former subsist in part on a vegetable diet.

Mention remains to be made of the landing of the yearling and two-year-old females, whose brothers come to the islands about the first of July and spend their time on the hauling grounds. The two-year-old females reach the rookeries about August 1, and take up their places either in the old harems, or in fresh ones in front of and behind the regular breeding-grounds. Here they are taken charge of by young bulls, and after a short sojourn return to the water. Although the yearling cows apparently arrive with the two-year-olds, they do not make their appearance on the rookeries much before September, and then spend their time in ranging over the latter and playing with the pups, which by this time have become strong swimmers.

In regard to the breaking up of the breeding-season, the old harem-bulls, who have fasted from the beginning of May, begin to desert the rookeries for the feeding-grounds about July 25, their places being taken by the idle bulls. By some time between August 5 and 10, all the adult bulls have departed; the breeding-grounds being then occupied by the younger bulls and bachelors, who, however, soon return to the sand beaches. At the first approach of winter, which usually occurs in November, the cows and pups start on their journey southward. The bachelors linger for some time longer, in some years a considerable number remaining till the end of December or even well on in January; while in mild seasons some may be seen all through the winter. As a rule, however, November ends the sojourn of the seals on the Pribyloffs, and, class by class, they set out on their winter migration.

Such is, very briefly, the life-history of the fur-seals during their sojourn around and on the Pribyloffs. We now proceed to notice, with equal brevity, the decline which has of recent years taken place in the numbers of the herd, the reasons for such decline, and the remedies suggested for its recovery. Since these islands came under the sway of the United States Government only bachelors of a certain age have been allowed to be killed on shore. From 1869 to 1889 the sealing rights were leased to the Alaska Commercial Company, whose annual quota of skins was limited to 100,000, of which 75,000 were to be taken on St. Paul and the remainder on St. George. On

<sup>1</sup> Two other parts of the Report are announced, the second (iv.) of which will deal with the Komandorski and Robben Island herds.

the expiration of this lease the islands were relet for a period of twelve years to the North American Commercial Company, on more advantageous terms, the quota of skins being fixed for the first year at 60,000, while it has since been under the regulation of the Secretary to the Treasury.

Putting aside for subsequent mention the question of pelagic sealing, it may be observed that between the years 1871 and 1875 the number of breeding seals and young on the islands was estimated by Mr. Elliott, in round numbers, at 3,193,000. In spite, however, of the fact that this observer did not recognise that only a portion of the cows were on land at any one time, the Commission concludes that this estimate is far too high, and that 1,400,000 would have been a much closer approximation to the truth. They further state that between 600,000 and 700,000 seems to be a fair estimate of the number of breeding females resorting annually to the islands between the years 1871 and 1885; while at the present time (1896-97) the number is only about one-fifth of what it then was.

As regards the decline of the Pribyloff herd, the best evidence is afforded by the fact that whereas between the years 1871 and 1885 no difficulty was experienced in obtaining the full number of 100,000 bachelor seals of the proper age before July 20, in 1896 it was only found possible to obtain 30,000 fit for killing even by continuing the drives till July 27; while in the following year, when driving was carried on as late as August 11, only 20,890 were obtained. It is largely on these data that the above-mentioned estimate of the former number of breeding animals is founded.

The life of the female seal being estimated at from ten to fifteen years, thirteen years may be taken as an average, during ten of which she is capable of producing young. On this estimate 10 per cent. of the breeding females die of old age each winter, in addition to those which perish from other causes. The stock is replenished by the annual addition of the three-year-old females. Among the young and pups the death-rate from natural causes is very high; about two-thirds thus perishing annually before they attain the age of three years, when the females are fit for breeding and the males for killing. The most important of such natural causes are the presence of a parasitic worm on the sandy breeding-grounds, the trampling to death by the ordinary movements or fights of the adults, starvation of the pups from being separated from their mothers at a very early age, destruction by the killer-whale, and drowning during the winter storms.

In 1896 the number of females with pups on the islands was about 157,000, and in the following year 130,000. In certain rookeries the number of pups had diminished from about 16,240 in 1896 to about 14,320 in 1897, indicating a decrease of about 12 per cent., the number of harems having likewise diminished by about 10½ per cent. Although precise figures are not available, the total decrease in the number of breeding females for the same period may be put down at about 15 per cent., and that of the males fit for killing at about 30 per cent.

Although the exact number to which it is safe to reduce the breeding bulls in a rookery as compared to the cows has not yet been ascertained, it is quite certain that in the Pribyloff herd there is no reduction of the former to anything near that limit. Consequently the killing carried on in the islands cannot be held responsible for the serious reduction which has of late years taken place in the numbers of the herd. On the contrary, such thinning out of the bachelors has tended to the actual increase of the breeding herd, owing to the less amount of fighting which takes place when the bulls are reduced in number, and the consequent diminished loss of life among the cows and pups owing to such fights.

On the other hand, there is every reason for believing that the waning of the herd is solely to be attributed to pelagic sealing, in which the number of females taken is very largely in excess of the males, while for each female so killed an unborn pup is also destroyed, and in the case of those which have already bred a second pup is starved miserably to death on land. Since the normal rate of increase of the breeding herd is a little short of 17 per cent., while the natural death-rate from old age is not far from 10 per cent., it follows (without allowing for other natural causes of death among the adults) that not more than about 6-2/3 per cent. of the females can be destroyed by human agency year by year without involving the ultimate destruction of the herd. This limit has been very largely exceeded as the result of pelagic sealing, in which (in spite of statements to the contrary) it is impossible to distinguish

females from males until too late; and in consequence of this the Pribyloff herd has been so reduced that neither pelagic nor land sealing yields an adequate profit on the money invested. The Commission, indeed, go so far as to say that from a commercial point of view the herd is virtually destroyed. "But this," they add, "has not involved the biological destruction of the herd. Under wise protection it may regain its former numbers." That such protection (which involves the prohibition of the killing of females, and therefore apparently also of pelagic sealing<sup>1</sup>) may be extended to the herd while there is yet time, must be the hope of every naturalist. R. L.

#### INHERITANCE OF LONGEVITY IN MAN.

THE object of this paper<sup>2</sup> is twofold, namely:—

- (1) To ascertain whether duration of life is inherited, and
- (2) To exhibit natural selection at work in man.

According to both Wallace and Weismann the duration of life in any organism is determined by natural selection. An organism lives so long as it is advantageous, not to itself, but to its species that it should live. But it would be impossible for natural selection to determine the fit duration of life, as it would be impossible for it to fix any other character, unless that character were inherited. Accordingly a preliminary inquiry as to whether duration of life is inherited or not seems needful before we consider further the plausibility of Wallace and Weismann's hypothesis. The present paper shows that directly and collaterally duration of life is certainly inherited in the male line. We believe this to be the first quantitative measure of the inheritance of life's duration. Further data for the inheritance of this character in the female line, and for the study of the inheritance of "brachybioty" or shortlivedness as distinguished from longevity are now being collected. We point out in the paper and endeavour to illustrate by examples the importance of such quantitative measure of the inheritance of life's duration for actuarial practice.

The second aim of our paper seems to us, perhaps, to have the greater scientific importance. In the presidential address at the Oxford meeting of the British Association we were told that no one had seen natural selection at work. In a criticism then published by one of us, it was suggested that every one who had examined a mortality table had seen natural selection at work. Now the meaning of natural selection is absolutely simple. All individuals die, but some, better suited by their constitution and characters to their environment than others, survive longer, and so are able, or better able, to reproduce themselves, and to protect for a longer period their offspring. To assert that natural selection does not exist, is to assert that the whole death-rate is non-selective, or is not a function of the constitution and characters of the individual. Looked at from this standpoint the existence of natural selection really becomes a truism. All that remains when we desire to see it at work is to determine the relative amounts of the selective and non-selective parts of the death-rate for individuals living under the like environment. If, therefore, individuals living under much the same conditions are dealt with, the determination of the selective and non-selective death-rates is a measure of the quantitative amount of natural selection. Now we can answer this problem in two ways. First we may take any organ, and determine whether the death-rate is a function of the size of this organ. This method, adopted by Prof. Weldon, would be the direct and best method, if the results were not apt to be screened by other factors. In the first place we have to hit upon some organ upon which vitality largely and sensibly depends; and this is not easy, for constitutional power of resisting the attacks of disease may depend upon, not one organ, but on the complex relationships of a system of organs, and in the next place the whole problem is rendered difficult by changes due to growth. In the second method we do not attempt to select any organ whatever, but select individuals having any general

<sup>1</sup> The writer takes this opportunity of mentioning that, misled by a summary of some of the evidence given before the Paris Commission, he was inclined in the "Royal Natural History" to pronounce pelagic sealing more humane than seal-killing on land.

<sup>2</sup> "Data for the Problem of Evolution in Man. II. A First Study of the Inheritance of Longevity and the Selective Death-rate in Man." By Miss Mary Beeton and Karl Pearson, F.R.S., University College, London. Received May 29. (Abstract of a paper read before the Royal Society, June 15.)