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Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954

Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK

The Pedagogical Seminary

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/vzps20>

Origin and Development of Home and Love of Home

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Published online: 30 Aug 2012.

To cite this article: L. D. Arnett (1902) Origin and Development of Home and Love of Home, The Pedagogical Seminary, 9:3, 324-365, DOI: [10.1080/08919402.1902.10534188](https://doi.org/10.1080/08919402.1902.10534188)

To link to this article: <http://dx.doi.org/10.1080/08919402.1902.10534188>

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ORIGIN AND DEVELOPMENT OF HOME AND LOVE OF HOME.

By L. D. ARNETT, Fellow in Clark University.

The object of this study is to set forth some of the conditions of the care and provision for offspring and to follow out, in a general way, the widening stream of interest in the welfare of progeny as shown by any preparation of the parents for them. This presupposes in a general way what is meant by home. Home in general, and in the wide sense of the word, is the place where offspring are born and pass through the stage of helplessness to that degree of maturity whereby they are able to gain their own subsistence. It centers around the spot selected by the mother and on her precision, erring or unerring, depends the continuation of the species. The conditions of the environment necessary for the life of the protozoa are comparatively simple. The short period of birth, if it may be so called, since the two organisms produced¹ are exactly similar, except in size, to the parent, renders the food of the parent suitable for the offspring. The environment in which the parent thrives well is especially suited to rapid multiplication of offspring.

A few instances may be noted where eggs are even deposited, apparently, without any provision on the part of the animal as to the future of its species, yet nature in her workings is not prolix, and the law of parsimony is everywhere predominant. Many insects deposit their eggs where they feed because their larvæ are able to feed on the same. Brauer's Classification is based on the similarity or dissimilarity of the food of the larva and imago.

The vast body of life of the ocean is one in which the different forms are ceaselessly feeding on one another. It is a basin of food, of which the countless offspring are evidence. Among the vast majority of its life the offspring can subsist beside the parent, and the one condition necessary is, that the number is great enough that one, of each sex, out of the 9,000,000 eggs laid by the cod,² for example, may reach the procreation period. The monotony and density of marine life,

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¹Balfour: *Comp. Embryology*, p. 7.

²Günther: *The Study of Fishes*, p. 160.

save for the effort to escape being destroyed, is so great that the least limited sphere of activity and neurotic development is called forth.

Some Conditions Fundamental to Nest-Building. The selection of some particular place for the eggs, and especially the concealment of them in some way from enemies marks a great advance. The long journey of the salmon from the sea, costing the adult its life, shows how necessary it is for the eggs to be deposited in their proper place and what a sacrifice the individual makes for the species. Insects have a great advantage over some other species in the amount of food. While some of them thrive on special plants others have a variety of foods. The common nettle¹ is fed upon by thirty distinct species of insects while the cabbage furnishes food for two hundred different kinds. The great mantle of green herbage, almost without distinction, furnishes food for some of the larval forms. Among the lepidoptera, where the eggs are very numerous, Sharp² thinks they are discharged almost at random in suitable spots, but moths such as the *Clesiocampa neustria* fasten their eggs around the stem of the food plant in a very perfect and artistic manner. He says, that some of the butterflies seem to prefer to oviposit by placing an egg here and there and do not seem to risk many in one situation. Trouvelot noticed, in his study of the silk worm (*Telea*), that while the moths laid their eggs on the leaves and twigs, that they were sometimes laid on plants which the larvæ refused to eat, and, since there was none near on which they could feed, they perished. The color of the egg is a means of protection, and its value for that purpose depends largely on the environment. This is noted most strikingly among birds. In his study of life forms Erasmus Darwin³ observed that "the eggs of hedge-birds are greenish with dark spots; those of larks and partridges are russet or brown, like their nests or situations." Poulton⁴ thinks that a process of natural selection has brought the change in color of birds' eggs from the original whiteness of the serpent. Unconcealed eggs are almost invariably colored or marked in some way, while with concealed eggs natural selection has ceased to work and if they have been of a different color they have reverted to the original. The colors of the eggs of the barnyard fowl may be cited as an instance of

¹Badenoch: *Romance of The Insect World*, p. 39. (*Note.* This estimate of the insects living off the cabbage plant includes those that feed on the cabbage parasites.)

²Camb. Nat. Hist., Vol. VI, p. 322.

³American Nat., Vol. I. Silkworms.

⁴Zoonomia, Vol. I, p. 510.

⁵The Colors of Animals, p. 62, *seq.*

the slow reversion from the brown color of the egg of the jungle fowl to the white color. Whether surrounding objects can affect the color of the eggs has not been definitely determined. The formation¹ of the shell and the deposition of the pigment forming the markings is a process usually referable to the walls of the oviduct, and is related to the pigments of the blood and bile. For some influence birds have been known² to vary the color of their eggs. Erasmus Darwin³ thought that it was due to the imagination of the female while others have thought that the nervous system is the direct medium through which the environment acts.

The safety of the egg is further ensured by many animals against extremes of temperature. Like the germination of the seed, a certain temperature must be maintained for a definite time to set in motion the rhythmic action of life. The migration of fish to their spawning ground is thought to be excited by the approach of the temperature of the water towards a limit that is favorable for the hatching of the eggs. The change⁴ may be an approach toward warming or toward cooling water. Too cold temperature delays hatching, and as they lie open to the attacks of enemies the chances of their hatching and reaching maturity is lessened. Insects usually place their eggs where they will not be affected by the scorching rays of the sun.

An example of the economy of nature is found in the adjustment of the food stored up in the egg case to develop the fertilized ova. Without any waste the food is just sufficient for development to a stage where some other method of getting nutriment is already provided. Gadow⁵ says that as a rule "the greater the amount of yolk the smaller the number of eggs produced." The yolk-glands of the eggs of the lowest worms⁶ represent a degenerate portion of the ovary. In these the cells have become more highly nutritive than ova. Gegenbauer thinks that the origin of the yolk-gland is probably to be found in the division of labor of a primitively very large ovary.

The yolk is a store of food collected around the ova, to a greater or less extent from the germinal epithelium of which it is originally a part. For most⁷ animals this forms a large part of the stored up food. Another source of supply in

¹Geddes and Thomson : *Evolution of Sex*, p. 104.

²Nature. Vol. VI, p. 547.

³*Op. cit.*, p. 511.

⁴Report U. S. Fish Com., 1876, p. 507.

⁵Camb. Nat. Hist., Vol. VII, p. 53.

⁶Geddes and Thomson : *Evolution of Sex*, p. 61.

⁷Hadden : *Study of Embryology*, p. 5.

some animals is found where the primitive ova feed upon its neighboring germ cells. This method of storing up is characteristic of some Hydrozoa, insects, etc. A third source, found among many of the lower worms, represents the degenerate ovary. These cells collect about the ovule and form a future store of food.

The quantity of food thus stored up about the ova is characteristic of the species and is adjusted to the later stages of food and growth. Where no future provision of care is destined by the parent proximity to its future pabulum is essential. The insect world is dependent to a very great extent on the certainty of the larvæ finding the proper food. Yet this store is so great that the risk may be small. Of the vegetable feeders, even if many are illy placed for food, the chances are always in favor of the great majority surviving. Wallace¹ noticed instances of misguided selection among the insects of the Malay Archipelago.

Some of the *Ptilenus* find their life-long food in decaying or dry wood fiber, and this condition may even be produced by insects for their young. The Hickory² girder, one of the Longicorn beetles, cuts a groove about one-tenth of an inch wide and the same depth around the young shoot just below where the egg is deposited.

Most of the vegetable feeders among the insects prefer the living fiber. Gall flies,³ for instance, deposit their eggs in the living tissue of the leaf or stem and the resulting excrescences are due to larval irritation. Weismann⁴ mentions the description of an insect (*Rhodites rosæ*) depositing her eggs in the tissue of a young bud. He says that "she first carefully examines the bud on all sides and feels it with her legs and antennæ. Then she slowly inserts her long ovipositor between the closely rolled leaves of the bud, but if it does not reach exactly the right spot she will withdraw and insert it many times, until at length when the proper place has been found she will slowly bore deep into the very center of the bud, so that the egg will reach the exact spot where the necessary conditions for the development alone exist."

Insects that feed upon animal tissue are more limited in their supply of food. Decomposing animal matter is a spot selected for the larvæ of the blue meat-fly.

The different kinds of solitary wasps store up their provision in order that it may be ready for the larvæ. Other insects pass their entire existence inside their carnal food.

¹ Malay Archipelago, p. 365.

² Pop. Science Mo., Vol. XXVI, p. 695.

³ Hyatt: Insecta, p. 233.

⁴ Weismann on Heredity, p. 94.

Reaumur¹ experimented on the meat-fly by placing one in a vase with a piece of fresh meat. The irregular heaps of eggs at different places on the meat amounted to about 200 and were deposited in less than half a day. In less than twenty-four hours the larvæ hatched and began their work of burrowing into their food.

Loeb² made some studies on the attraction of the fly to particular kinds of meat. He came to the conclusion that the guiding influences are tropic in effect, and the excitation is caused by the effluvia of the particular kind of meat. The fly turns toward this larder from a cause not unlike the moth flying into the flame.

Living tissue as a dwelling place for animals, especially under the head of parasitism, has attracted no small amount of attention. It represents a kind of animal world within itself. Cobbold³ regards the entozoa collectively as forming a special fauna, whose "territory is the wide-spread domain of the interior of the bodies of man and animals." Parasitism in general is attended by degeneration. The structure of the body while in its early stage may represent a higher place in nature and a more complex organism, but their quiescent manner of life permits the atrophy of unused organs. The food is easily obtained and it is often in a form of ready assimilation. The only class of parasites to be considered in this study are those in which the young at least are parasitic. An example of this class, frequently observed is the Ichneumon fly. The imago of this species has one object in life and that is to find some larva on which to deposit her eggs. Thomson⁴ mentions one that was observed to remain under water twelve hours, adopting a new medium for living and using her wings for oars, in search of some particular larval form. Another species⁵ (Black Thalessa) bores into the hard wood to deposit her egg in the burrow of the Tremex. With no mark to guide the human eye she locates the spot where her long ovipositor may penetrate the burrow of the larva and is thus able to carry on her species. So general is the warfare carried on by the Ichneumon family that no less than thirty-five species direct their attack on one of the Bombyx moths. The female of the Scolea,⁶ another of the Hymenoptera, penetrates into the ground in August or September in search of the larvæ of the Cetonia. When a suitable larva is found she stings it suffi-

¹ Figuiet : The Insect World, p. 76.

² Physiology of the Brain, pp. 186-188.

³ Parasites, p. 2.

⁴ Studies in Animal Life, p. 109.

⁵ Hodge: Nature Study and Life, p. 247.

⁶ Van Beneden : Animal Parasitism and Messmates, p. 165.

ciently to paralyze it, but not severely enough to kill, and deposits her eggs on the ventral surface. As soon as the larva is hatched it penetrates into its larder and gradually consumes it until only the skin of the empty *Cetonia* remains. The Bot-fly is another example of larval parasitism. "Guided by a marvellous instinct," says Figuiet,¹ "the female *Oestrus* generally places her eggs on those parts of the horse's body which can be most easily touched with the tongue, that is, at the inner part of the knees, on the shoulders, and rarely on the outer part of the mane." A further refinement is carried out by some insects to the extent of making the egg itself a larder. Insect parasitism is most favored by the minute size of the animal. The short duration of life of the adult tends to confine its destructive influence chiefly to that of larval forms.

The finely adapted ovipositor is no small vantage favoring the safety of young. In the struggle for existence the egg must be so placed that the helpless young will find the proper food at the exact time, and oftentimes it is of consequence at what place the young begin work on their larder. It is also significant that the ovipositor is often associated with the organ of defence, as though the fatal blow had something to do with the placing of the egg. Among the Hymenoptera the ovipositor is transformed into the sting. In the Saw-flies² it is used for cutting holes in the leaves, in which the eggs are deposited. In the Horntail³ it is a borer attached near the middle of the lower side of the abdomen and "consists of a long, pointed implement encased in horny sheaths." In the Ichneumon (*Thalessa astrata*) it is a long borer and it is protected by two sheaths which unite to form a tube. It is used by the grasshopper to scoop out the hole in the hard ground in which the female lays her cluster of eggs. A somewhat different adaptation is made by the weevil in using its stiff proboscis for boring. Many instances might be given, in each case of which there is an almost perfect adjustment of the ovipositor to the mode of life of the species. Through the process of natural selection the delicacy of the arrangement of this instrument has to a certain extent taken the place of care by the adult insect. Generation after generation have been produced and the structural development has reached such a stage that the nervous structure responds mechanically to the proper stimulus. Thomson⁴ says if we wish to explain insect life we must think back over the development of the species. It is quite possible if we had the steps of development much of the mystery would disappear.

¹The Insect World, p. 60.

²Hyatt: *Insecta*, p. 231.

³*Ibid.*, p. 233.

⁴Studies of Animal Life, p. 108.

Traces of Interest in Eggs. In the previous section the object has been to present the simplest forms of interest in the welfare of progeny. In the lower forms of life the process of egg-laying can be little less than a reflex in response to favorable environment. No doubt the first traces of the care of eggs is the result of a structural arrangement and as such has gradually been developed in response to its need. The female Cyclops¹ carries her eggs in an external pair of ova-sacs. The female lobster is provided with two leaf-like swimmerets to which the eggs are attached. During the breeding season these swimmerets are covered with a sticky substance which glues the eggs fast until they hatch. Espinas in his studies of animals has noted that the first care on the part of the parent is the female. She alone exercises this, where it is present among the crustacea and insects. While care by the male begins among the fishes and can be traced to a varying degree through the orders of amphibia and birds. Among the Siluroid² family of fishes the female Aspredo carries the eggs in the soft integument on the lower part of the body.

At the time of propagation the integuments of the lower side of the trunk assume a soft and spongy texture. After the eggs have been deposited by lying over them she attaches them to her and presses them into the soft parts. When the eggs have hatched the abdomen becomes smooth again. For another member of the same family of fishes, the Solenostoma, the ventral fins coalesce with the soft integument and form a pouch for carrying the eggs. Long filaments line the inner side of this sack as a further precaution for the retention of the eggs. ³Interest in the welfare of the eggs is much more frequent in the male than the female among fishes, and the line of protection is generally some method of carrying them. Among the pipe⁴ fish, the Siphonostoma, the cutaneous folds of the tail form a broad pouch; for the Doryichthys dilated parts of the abdomen form a groove; for the Nerophis the integument of the abdomen is softened in the male and serves for attachment; for the Hippocampus, a sack at the base of the tail encloses the eggs.

In some species of Arius⁵ the eggs are carried in the pharynx. Among amphibia there are similar adaptations. The ova is placed by the male on the back of the female Surinam toad, where the softened integument forms a receptacle. The male,⁶ Alytes obstetricans carries the eggs entwined about his

¹Nicholson: Manual of Zoölogy, p. 340.

²Günther: The Study of Fishes, p. 160.

³Günther: *Ibid.*, p. 160.

⁴Parker: Mammalian Descent, p. 85-86.

⁵Geddes and Thomson: Evolution of Sex, p. 255. ⁶*Ibid.*, p. 87.

hind legs and retreats to a burrow for safety, coming out at night in search of food. He may even give his unborn wards a bath occasionally to ensure their safe hatching. Near the time when the young tadpoles come forth he betakes himself to the water. A part of Boulenger's¹ Summary will shorten detailed examples: Eggs are carried by parents:

A—by male. 1, round the legs; *Alytes*. 2, in vocal sacks; *Rhinoderma*.

B—by female. 1, attached to belly; *Rhacophorus reticulatus*. 2, attached to back; *Pipa*. 3, in "dorsal" pouch; different species of *Nototrema*.

In his discussion as to the origin of care on the part of the male, Espinas thinks that it is a widening out of the interest displayed by the female; and for the fishes he sums it up by saying that: "The father² feels an interest in the fertilized eggs because he regards them as a part of his own body; he cares for them because he knows that they are alive." The latter statement however might be questioned. Interest in the welfare of the ova is expressed in other ways. The male stickleback watches carefully over his nest, and keeps the water in gentle motion for a fortnight. The least disturbance brings him madly at the intruder.

The alligator lies in close proximity to the place she has deposited her eggs. The incubating fowl shifts the position of her eggs in the nest. Moisture is borne on the feathers to furnish the necessary dampness. The cuckoo³ carries her eggs in her bill and places them in nests that otherwise are not available for the process of ovipositing. It may also be possible that she selects those nests whose environments are in harmony with the color of the egg.

The wagtail⁴ has been known to remove its eggs to a different position when disturbed. Brehm asserts that an American nightjar, when disturbed, transported her eggs one after another to a more secure place.

What shall we call this interest in the egg? Is it love? If it is not it is the basis for it. Whether we call it love or not, it represents an industry that is so vital among intermediate forms of life, that they will often sacrifice their own life in defence of their treasure.

Evolution of the Nest. Nest-building represents an adjustment of life to environment for the better care and protection of progeny, and oftentimes the nest offers a means of protection for the parent. It represents also an extrasomatic state where-

¹ Ann. Nat. Hist., XVII, p. 463.

² Die Thierischen Gesellschaften, p. 393.

³ Poulton: The Colors of Animals, p. 66.

⁴ Nicols: Zoölogical Notes, p. 217.

by external substances are utilized as a protection for the period of infancy. The first approach to it is perhaps found in the burrowing instincts of certain marine forms, and, like some of the other anomalies of this lower fauna, the burrow is constructed for the concealment of the mature individual. Some of the marine annelids burrow for protection. The common earth-worm finds its home in a burrow. Among the mollusks,¹ the marine snail (*Helix saxicava*) bores into the rocks for places of safety, using, it is thought, its gastric juice to dissolve the particles of stone. Other mollusks, as the *Pholas*, *Saxicava*, *Razor Shell*, etc., have similar habits. Many of the crustaceans have peculiar instincts for concealing themselves in different ways, as though realizing their helpless condition. The land crabs are notable for their burrowing habits to secure places of safety.

Burrows for homes. Burrows in wood and in the earth, by land animals, are more properly retreats in the sense of houses. They represent places of safety for the adult, and are fitted out with nests for the young. Perhaps one of the extreme necessities for the burrow, in the case of many animals, is to afford a safe place during the hibernating period. A few of the reptiles and the tortoises burrow for this purpose.

The ants and the termites, in comparison to their size, are the most extensive burrowers. According to McCook² the first act of the fertilized queen is to go apart and found a new formicary. In doing this she does not cease her work until she has excavated a gallery from two to six inches in depth. Then comes the duty of rearing and providing for the first brood of workers, and it is probable that her share of the work of gathering food and excavating does not cease until the family is well increased in numbers. The excavation is soon enlarged into a net-work of winding tunnels. Forel³ and Espinas,⁴ and others in their studies of ants have noted that the great number of tunnels and that the irregularity of the entire structure is due to the perfect freedom of each ant to work out its own plan. Only after a second ant has caught the plan of the first, does it assist, and others join in the work. The persistent patient worker may succeed, after many fights for supremacy, in winning others to its plan and lend shape to a part of the work. Each one starting independently—often destroying what others have done—is the key to their labyrinthian home.

¹ Wood: *Homes Without Hands*, pp. 114-128.

² *Agricultural Ants of Texas*, p. 99.

³ *The Social Life of Ants*, Int. Monthly, May, 1902.

⁴ *Die Thierischen Gesellschaften*, p. 371.

Moggridge¹ placed some Barbara ants in a glass jar in the evening, the next morning there were ten openings in the soil. He says, "It seems to me that the ants displayed extraordinary intelligence in having thus at a moment's notice devised a plan by which the superabundant number of workers could be employed at one time without coming in one another's way. These numerous and funnel-shaped entrances admitted of the simultaneous descent and ascent of large numbers of ants and the work progressed with proportionate rapidity. After a few days only three entrances and eventually only one remained open." In their work imitation is manifest and it is thought that they are able to profit by experience to a certain extent. They are able to adapt themselves to new circumstances and the ability to choose seems to be manifested at times. The larvæ are cared for by the young ants, and their social nature no doubt to a great extent depends on the care and treatment during this period of helplessness.

Closely related to the ants in habits, and scarcely less remarkable for their wonderful burrows, are the termites. These live in societies similar to the ants and like some of them are divided into castes or classes. The two principal classes are the workers and soldiers. Grassi² thinks that the workers are individuals whose development is arrested. They resemble the young, their sexual organs remain undeveloped, and other organs, as the eye, are only partly developed. While there may be two classes, workers and soldiers, they are not differentiated so much in their instincts although there are modifications of structure. Food, or the mode of feeding, he thinks is what distinguishes the anatomical structure of the winged forms, soldiers and workers.

Among the mammals the mole is an extensive burrower. At some central point, leading to this by several underground paths, it constructs its nest. The hamster has a special apartment set off for the storing of grains for food. Most deep burrows have two or more entrances. These are valuable for ventilation and may be used for escape in case of danger. Among social animals, as the prairie-dog or Vizcacha, the individual burrows form a small village, and to a certain extent, regularity is observed in constructing them. For most mammals, the burrow in the tree, the retreat in the crevice of the rock, the lair under the shelter of the cliff, etc.; wherever the fixed abode may be; these places are fitted out with a soft lining of some kind for the comfort of the resident, and usually in addition soft nest material is provided when the young are brought forth.

¹ Harvesting Ants and Trap-Door Spiders, p. 44.

² Cambridge Nat. Hist., Vol. VII, p. 376.

Among insects the trap-door spider finds a similar retreat. The young animal or insect that finds its home in such surrounding seems instinctively to take up its work to construct such an abode.

Ingersoll¹ speaks of a young badger reared in confinement when allowed freedom would burrow for hours. The gnawing of rodents is familiar. Moggridge² mentions the burrowing habits of the young trap-door spider, and says: "That so young and weak a creature should be able to excavate a tube in the earth many times its own length and knows how to make a perfect miniature of the nest of the parents, seems to be a fact which has scarcely a parallel in nature."

Burrows Especially for the Young. The burrowing habits of insects and animals have led to special adaptations of jaws, beaks and claws. The mandibles of some of the beetles, the teeth of the rodents, the strong front legs and claws of the mole or badger, all indicate special adaptations that have developed along lines of vantage.

After the quiescent stage of summer the female *Scarabaeus beetle*³ enlarges its burrow and collects a food-mass to the extent of a moderate sized apple in preparation for its young. The material is so arranged that the egg may be deposited on the softest and most edible part of the food. As a further precaution, for the first meal, a small mass of more nutritious and partly digested food is placed near where the egg is to be laid. After ovipositing the burrow is sealed up.

The mother lives to rear a second generation during the summer. Some of the solitary wasps, on the contrary, construct well provisioned burrows for the young they do not live to see. These have been delightfully described by Peckham.⁴ The *Urinaria* is one of the interesting of the nesting wasps. After the female has dug a little burrow about an inch in depth she enlarges a little chamber. When it has been provisioned and the egg deposited it is closed with two or more pellets of dirt, and as a means of concealment more dirt is kicked over it.

The *Ammophila* is said even to use a stone to pound down the dirt in her burrow. Most of the solitary wasps place the egg on some particular spot of the larder; the *Sphex* placing it on the ventral side of the captured cricket. According to Peckham⁵ the adherence to a general style of nests is dependent on instinct, but individual difference and experience leads them to depart more or less from the type.

¹ Wild Neighbors, p. 144.

² Harvesting Ants and Trap-door Spiders, p. 126.

³ Sharp: Camb. Nat. Hist., Vol. VI, p. 197.

⁴ Solitary wasps.

⁵ *Ibid.*, p. 233.

Some of the birds, although perhaps less adapted to constructing underground habitations, find burrows suitable for their nests. The Kingfisher¹ is a common example. At the end of a short tunnel in the river bank it enlarges a chamber, and on the fish bones scattered therein for a nest, brings up its young. The sand martin² is a small bird constructing a similar burrow. Along the high sand banks, bordering the smaller streams, these small burrows may be numerous. They are worked in by the bird, using her beak, for a distance of about two and a half feet. In this sheltered retreat the nest is built and the young are brought up in safety, the position chosen is often difficult to approach.

One or two instances may be noted of burrowers in wood. Many insects, especially in their larval state find their protection here. The carpenter bee³ (*Xylocopa*) hollows out galleries in worm eaten wood, and constructs a series of cells in the tunnel. The cells are stored with food for the larva, and sealed. When they reach a certain degree of maturity they pass out of the burrows in succession, by boring through the partition separating the cells.

No small number of birds construct tunnels in wood for their nests. When the female Toucan has begun to incubate she is fastened up by the male. A hole large enough for feeding is left and here she remains, fed by the male bird, until the young are almost mature. Such care on the part of the parents is believed to have arisen from the pilfering habits of monkeys and serpents. As a general rule the burrow is a safe retreat, and marks a very great advance in protecting the offspring.

Nests constructed of plastic materials. In attempting to classify the constructive activities of animals no sharp and fast lines can be observed. The moulding of the nest from some pliable material represents an advance in the line of invention. The placing of things together for a definite end is one step, but when a definite arrangement and shape is to be accomplished with these materials the advance is still greater. Whether the female carries a psychic model as a part of her dowry, whether it is the result of experience, or whether it is merely a reflex are questions that have been debated in this connection. Bethe⁴ thinks it can all be explained on the ground of reflex action. Darwin⁵ observed that the construction of cells by bees seemed to be "a sort of balance struck between many bees all instinctively standing at the same distance

¹ Wood : *Homes Without Hands*, p. 79.

² *Ibid.*, p. 75.

³ Figuer : *The Insect World*, p. 367.

⁴ Pflüger's *Archives*, Vol. LXX, pp. 100, *seq.*

⁵ *Origin of Species*, p. 225.

from each other, all trying to sweep equal spheres." Maeterlinck¹ in his charming description of the bee says: "Their common sense has never been known to fail them; they have never, at a loss of definite decision, erected at haphazard structures of a wild heterogeneous nature. Though you place the swarm in a sphere, a cube or a pyramid, in an oval or polygonal basket, you will find on visiting the bees a few days later, that if this strange assembly of little independent intellects has accepted the new abode, they will at once, and unhesitatingly and unanimously have known how to select the most favorable, often humanely speaking the only possible spot in this absurd habitation."

One of the Myriopods² (*Julus terrestris*) when about to lay her eggs constructs a nest out of a mortar that she mixes. After burrowing down a short distance in the earth, she begins to form small pellets by moistening the bits of earth with the fluid from her salivary glands. "She works up these bits of earth with her jaws and front legs." When they are of convenient size and shape she places them together. The completed nest is shaped like a hollow sphere, the inside being smooth while the outside is rough. The nest is about the size of a small nut. She lays from 60 to 100 eggs through the opening left at the top and then she seals the little chamber with moistened earth and leaves them to their fate.

The Pelopæus, one of the solitary wasps, moulds the soft earth into a series of cells with her mandibles. In these she stores up spiders as food for her larvæ.

It was thought by Faber that the stored up prey had been paralyzed by a sting in some particular ganglion, but Peckham noticed that about as many of them were dead as alive. Many instances might be cited, especially among solitary wasps, of insects, moulding as it were, these cradles for the young. The honey bee moulds its cells of wax secreted in special glands, and the common wasp (*Vespa*) manufactures a kind of *papier-maché* by mixing the fibers of partly decayed wood with a salivary secretion. According to Hudson³ the Ovenbird of South America constructs a dome shaped nest. In the autumn, when the ground is moist, the bird is busily engaged gathering bits of mortar; these are cemented together, often with hairs, and when the nest is completed it is a foot or more in diameter. A partition is placed in it back of which is a softly lined nest. In general, moulding is one of the skillful arts of animal life, and since it represents a labor for the offspring it reflects another line of adaptation. The adaptation

¹ The Life of the Bee, p. 141.

² Sinclair: Camb. Nat. Hist., Vol. V, p. 38.

³ Naturalist of La Plata, p. 243.

is the building of something to encase the helpless young during the period of weakness.

Nests constructed of loose material. The simplest forms of this kind of labor may be observed among the amphibia. The female alligator¹ piles up some sticks and leaves near the bank of the stream. When the eggs have been deposited in this heap she lies in watch near by. The eggs are covered slightly but are incubated by the sun's rays. One class of birds, the Megapodia have a similar habit. The brush turkey² of Australia, for example, by tracing a circle of considerable radius, collects together a large heap of materials. In the work of building the male takes the initiative; when the eggs are laid he regulates the temperature of the fermenting mass by uncovering them during the day, to secure the heat of the sun's rays, and at night, again, scratches some material over them. When the young emerge they are able to care for themselves.

Excepting the four genera, comprising the megapodia, birds exert more or less care of incubating and feeding the young. In fact the uniformity is greater, in this respect, than in any of the other classes of vertebrates. Some classification is usually made in studies of their nesting habits. The division selected by Sutherland³ will serve for this treatment. He divides them into three groups: first those of a low degree of intelligence, comprising the Ratitæ or running birds; a medium grade consisting of the lower half of the Carinatae or Keel-breasted birds; and a third grade of superior intelligence consisting of the upper half of the Carinatae, including the Passerines, birds of prey, etc.

Among those of the first class the ostrich,⁴ for example, merely digs a hole in the sand where the eggs are deposited. A large part of the duty of incubation falls to the lot of the male bird, and in most cases he looks after the care of the young. The rhea and cassowary have similar habits. The second class includes birds like the barnyard fowl, pheasant, quail; marine birds as the petrel, gannet, penguin, etc., and other birds exercising little care in nesting as the pigeon, snipe, woodcock, etc. These comprise a great number of the avifauna and represent an advance in the structure of the nest, using sticks and grasses or perhaps some mud for building, and lining it with some soft material and often with feathers.

¹ Clark: Habits and Embryology of the Amer. Alligator; Jour. of Morph., Vol. V, p. 187.

² Nicols: Zoölogical Notes, p. 288.

³ Sutherland: Origin and Growth of the Moral Instinct, Vol. I, p. 58.

⁴ Nicols: Zoölogical Notes, p. 348.

The third grade represents the highest class of bird life. Among these the male and female, usually, both take part in building the nest, and the male takes his share of incubating, and of feeding the young. In this group are found such birds as the orioles with their intricately woven nest, swinging from the end of some branch. The humming birds delicately conceal theirs on the side of some limb; the parrots may accept some burrow in a tree; the birds of prey build massive nests, usually in the tallest trees, or on some elevated inaccessible place; the sparrows and thrushes conceal theirs in the grasses or among the bushes.

In regard to the habits of concealment, Oswald¹ says: "Animals in a state of nature are endowed with certain protective instincts to a degree which might often tempt us to believe the existence of a sixth sense. The nest of a green-finch on a willow, or chestnut tree defies detection, unless you should happen to espy the bird in the act of feeding her young." The tanager never takes a bee-line to the nest, quails, plovers and others feign lameness to deceive the intruder.

Burroughs² observes that nearly all the song birds build low; "their cradle is not upon the tree-top." A line five feet from the ground would run above more than half of all birds' nests and one ten feet would include three-fourths of them. The third class, of the division, represents the beautiful architecture of bird life. Many of the song birds, and especially those that care most for their young, show their high degree of intelligence in the preparation they make for the stage of weakness and immaturity. As in mammalian life the period of helplessness varies widely among birds. This highest class, as if realizing this period, build stronger nests and usually have a special lining in them.

Birds' nests in general. Wallace³ was of the opinion that the young bird learned by observation and experience how to construct the nest. It has also been suggested⁴ that probably an old bird mates with a young one, and thus they carry on the nest characteristic of the species. Dixon⁵ noticed that some young chaffinches taken from England to New Zealand were at a loss how to build the traditional nest, and finally constructed nests similar to those of the hang-nests of that

¹ Zoölogical Sketches, pp. 97-100.

² Birds and Bees, p. 28.

³ Natural Selection, p. 107.

⁴ *Ibid.*, p. 108.

⁵ Nature, Vol. XXXI, p. 533. (Dixon has recently written a book setting forth all the evidence he can collect to prove that the young bird builds by observing others of his species.)

country. While no definite experimental work on this point has come under the observation of the writer; and a discussion of the question could not find place here; yet the evidence seems to be that the process has an intelligent basis to such an extent that it could hardly be classed as a reflex act.

As the environment changes with the progress of civilization, if it is not destructive of food, bird life is responsive. The nest is woven with new materials, Burroughs¹ speaks of the change in the habits of the chimney swallow. The chimney is now preferred for nesting to the hollow tree.

Audubon records that the gulls along the St. Lawrence,—within the memory of the settlers there at that time—became arboreal when their eggs were being destroyed by the fishermen.

The tooth-billed pigeons² of Samoa became arboreal when their species was imperiled by the introduction of domestic animals. These changes in the habits of bird life denote an intelligence that responds readily and adapts itself to changes in the environment. The voluntary adaptations of bird life present themselves to our notice far more frequently than those of insects or mammals. The settling and cultivation of thickly populated areas has presented a new field almost entirely for bird life, but where they find protecting influences and food they continue to rear their brood as faithfully and as contentedly beside the great factory as in the remote forest.

Incubation. Incubation, in its more perfect forms as found among birds, has grown up with the evolution of new types of life, and probably as a result of the protection of the eggs and a disposition to remain with them.

Among some of the limbless amphibia³ (*Ichthyophis glutinosa*) of tropical countries a simple process of incubation is found. The female digs a shallow nest near a stream of running water. When the eggs, about two dozen, are deposited the female coils around the entangled bunch to protect them. Among the reptiles⁴ several species of the python have been observed to coil around their eggs, and some other species have a similar habit. Birds present the most perfect adaptation for this process. The nest is constructed to fit the body; and while feathers serve more than one purpose for the bird, they seem to be specially suited for incubation. The skin is thin and the temperature of the body is probably the highest of animal life. Nicols⁵ observes that it is a regular hot-house

¹ Birds and Poets, p. 91.

² Sharp: Wonders of the Bird World, p. 49.

³ Gadow: Camb. Nat. Hist., Vol. VII, p. 91.

⁴ Origin and Growth of the Moral Instinct., Vol. I, p. 53.

⁵ Zoological Notes, p. 51.

process—a forcing to rapid development. The temperature has been noted to rise at this period. Espinas¹ notes that during the period of egg-laying the bird is in a general feverish condition. The seat of this being the “*brüt-plexus*.” He further suggests that the incubating period is one of rest that follows this stage of excitement. The temperature of the python² has been noted to rise several degrees during incubation. Whitman³ recognizes three phyletic elements, which he thinks are rooted far back in preavian forms, in the incubating instinct. The first is the disposition to remain with or over the eggs, as is the case with certain mollusks and worms; second the disposition to protect them from enemies, as with the stickleback; third a periodicity that coincides with the recuperative stage.

The perfection to which it is developed in bird life is no doubt a concentration along more than one channel of development. A noteworthy fact is the part the male takes in incubation. This interest on the side of the male begins among the fishes. Among the highly specialized forms of birds the male takes his share of the work of incubation. The ostrich in this respect may be considered as highly specialized. Incubation as a process of external development represents the growth of interest and care for the welfare of the ova, and the induction of the male to a part of the work represents the tendency of this interest to become more and more intensive and extensive.

Special adaptations of the organism. When the ova is extruded, one of the simplest of useful developments is exhibited by glands, the viscid secretion of which moors the ova and keeps them in place. Some moths cover the eggs with fur from their own body, “which,” in the case of certain of the Eggers (*Lasis campidæ*), seems to have a special supply for the purpose.”

The Janthina,⁴ a reptile, swims to the surface of the water, and by a peculiar bending of its body enfolds air bubbles, these are held together by a secreted slime forming a raft, to these the eggs are fastened and held suspended in the water.

The spider has all the material for constructing the delicate cradle for its eggs, and plenty left to spread a large net for capturing food.

Emerton⁵ describes the formation of the egg cocoon. The female (*Drassus*) spins a little web across her nest, and drops

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¹ Die Thierischen Gesellschaften.

² Sutherland: *op. cit.*, p. 51.

³ Biological Lectures, 1898, p. 324.

⁴ Sharp: Camb. Nat. Hist., Vol. VI, p. 322.

⁵ Schneider: Die Thierische Wille, p. 174.

⁶ The Structure and Habits of Spiders, p. 99.

the eggs on it. These are mixed with a liquid and "are discharged in one or two drops of jelly." After the eggs are laid the spider covers them with silk, drawing the threads over them from one side to the other, and fastening them to the edges of the web below. When the covering is complete she bites off the thread, that holds the cocoon to the nest and finishes off the edges with her jaws." Romanes¹ has offered an explanation as to the origin of the web-building structure, and thinks it has been carried over, or at least is a concomitant of certain larval forms. That its first use was that of locomotion or cocoon spinning as it is used by some caterpillars for descending from heights and others for spinning the cocoon. He says: "It is easy to see how if there were any original tendency to secrete a viscid substance—this might be utilized in descending from low elevations (as certain kinds of slugs use their viscid slime as threads to let themselves from low branches); and so we can understand how natural selection might thus have the material supplied" to develop even spinnerets.

Other instances might be given of secretions, of a physiological basis, arising as the period of procreation approaches; as that of the "supra-salivation" of certain swifts (forming edible birds' nests) and that of the male stickleback. The latter² according to Möbius weaves together his nest with special catabolic elements, in the form of mucous arising from the pressure of the enlarged testes on the kidneys, at the period of sex excitement. The viscid secretion with which the paradise fish of India glues together the air bubbles for a nest may have a similar basis.

If the ova, instead of being extruded when it is ripe, hatches within the oviduct of the parent the chances of destruction, compared with any external position it may have, is lessened. How such a process could have arisen might be explained from the habits of certain oviparous reptiles. A constrictor³ kept in confinement gave birth to a family of living young. The explanation being that the eggs were retained, one by one, near the cloacal aperture until the young emerged. The retention was perhaps induced by finding no suitable place to deposit them. This represents the first stages of one of the great economic processes of nature. Its maximum perfection is found in the complex intra-uterine development of the human race. The oviduct as a depository for unripe ova is common among some fishes (180 species according to Suther-

¹ Animal Intelligence, p. 208.

² Geddes and Thomson: *The Evolution of Sex*, p. 251.

³ Nicols: *Zoölogical Notes*, p. 27.

land);¹ and to a lesser extent among the amphibia as a whole, while about one-half of the reptiles are viviparous.

The marsupial represents an imperfect stage, yet a great advance. The young are brought forth at the completion of their ovarian development and placed by the mother in an external pouch. The lacteal food is forced into their mouths by special muscles surrounding the mammæ. The soft fur-lined pouch affords a portable nest for the young. Among the mammals above the marsupials the ova is supplied with little food and upon hatching a union is established between the parent and offspring by means of the foetal membranes of the latter. Through the various modifications of these membranes nourishment is drawn from the parent until the expulsion of the young. Hertwig² thinks that the mammalia "have descended from animals which possessed large eggs with abundant yolk, which were oviparous," and in which consequently the embryonic membrane were developed in the same way as in the eggs of reptiles and birds. Mammals higher than the marsupials are generally divided into two classes as regards the intra-uterine development. This is based on the degree of complexity with which the embryo is united to the walls of the uterus. The lower class of mammalia, the non-deciduate placentalia, according to Landois and Sterling,³ possess only chorionic villi supplied by the umbilical vessels, which project into the depressions of the uterine mucous membrane, and from which they are pulled out at birth" (*e. g.*, pachydermata, cetacea, solidungula, camelidæ). In the ruminants the villi are arranged in groups which grow into the uterine mucous membrane. Among the deciduata the union between the chorionic villi and the uterine mucous membrane is so firm that the uterine part of the placenta is separated with the foetus at birth.

This mode of development leading to the formation of the womb represents a constructive process on the part of the female for the young, but destructive in its general effects on the parent. The sacrifice of her body for the food and shelter of the young. Among some insects the sacrifice is even greater if less perfect in its general completeness. The female scale insect extrudes her eggs and the dried shell of her body forms the covering and protection for them. The cochineal insect becoming full of eggs dies, and thus protects her offspring, encased within her body. So important is species and so great is the struggle for survival that every superfluous element is sacrificed, and only the highest possible economy fulfills the

¹ Origin and Growth of the Moral Instinct, Vol. I, p. 36.

² Embryology, p. 222.

³ Text-Book of Human Physiology, p. 876.

requirements of nature. Such an advance is that along the line of viviparous development. With the life of the female goes food and shelter for the young, and among the highest mammals and man an intelligent care whose influence in moulding the nature of the young according to that of the species makes up one of the great forces of life.

The house as a dwelling. It is thought¹ not improbable that the first steps in architecture were shelters or shed-like constructions for the protection of the sacred fire. That public, and private, sacred and profane architecture, have alike sprung from these rude beginnings, which only after a time men dared to inhabit. This theory of the beginning of any kind of artificial shelters antedates the testimony of the remains of the primitive cave-dweller. The troglodyte was content with the cave, or, later scooped out the soft stone along the banks of the Marne Valley to resemble caves. Some² think the Eskimo huts to be the representatives of these old cave-huts. The Adaman³ Islander may still be seen to scoop out his bed in the sand under cliffs. Houssay⁴ arranges the dwellings of animals in three sets; (a) those which are hollowed out in the earth or in wood; (b) those which are constructed of light materials often woven together; and (c) those which are built of clay or similar material. We may compare these to the caves, wigwams, and buildings in which men find their homes.

The second class are the homes of the nomadic tribes. The tent or wigwam is a temporary house, and is taken along from one place to another when in search of food. This arrangement is especially characteristic of most Indian tribes. Some tribes, not included in this classification, as the Bushmen,⁵ live in crevices among rocks, and in South America⁶ the naked Puris make shelters or sloping screens of large palm leaves. The Botocudos stick the large palm leaves in the ground and draw the tops together. Australians set up a line of leaf boughs to break the wind for the night.

Such habitations approximate that of the higher apes. The Orang prepares himself a sort of nest; "little"⁷ boughs and leaves are drawn together round the selected spot and bent crosswise over one another, while to make the bed soft, great leaves of ferns, of orchids, etc., are laid over them. 'The rude hut' says Sir James Brooke, 'which they are stated to build

¹ Reclus. Enc. Brit. Fire, p. 230.

² Starr: Some First Steps in Human Progress, p. 150.

³ Tyler: Anthropology, p. 229.

⁴ Thomson: The Study of Animal Life, p. 121.

⁵ *Ibid.*, p. 151.

⁶ Tyler: Anthropology, p. 231.

⁷ Huxley: Man's Place in Nature: Essays, p. 47.

in the trees, would be more properly called a seat or nest, for it has no roof or cover of any sort. The facility with which they form this nest is curious, and I had an opportunity of seeing a wounded female weave the branches together and seat herself within a minute.'''

Haberlandt¹ thinks that primitive man prepared this shelter principally for the purposes of sleep. Civilized man has controlled this according to his work, but for the savage the need of sleep was great.

The nature and the structure of the dwelling is dependent on the environment, and is generally suggested by it. The pile-dwellings which were prevalent at times in different parts of Europe were in fact rude castles for defence.

Mason² has recognized eighteen sections of America that are so distinguished as to give rise to as many kinds of habitations. The arctic area has given rise to underground igloos of earth on timbers or whalebone, snow huts and summer tents; Athapascan region to conical bark lodges; the Algonquin region to conical and cylindrical lodges of skin or bark; the Southern United States to huts of cane; plains of the West to skin lodges in circles; the North Pacific to communal barracks; Vancouver Island to communal houses; Interior Basin to shelters; California and Oregon to insignificant shelters; Pueblo region to differently constructed pueblos; Middle America to thatched and daubed huts and cut stone buildings; Littoral and Insular Americas to thatched huts; Cordilleras of South America to fortified villages and thatched huts; Andean Atlantic slope to thatched wooden houses; Eastern Brazil to immense huts and shelters; Central South America to open shelters, palm huts and roofs; Argentine and Patagonia to skin tolderias or awnings; Fuegians to miserable huts of wattle covered with grass.

Among the cliff-dwellers the desire for defense was the chief motive of the dwelling. It is thought³ that the structure of these habitations bear within themselves the record of a change from the nomadic to the sedentary condition of living and that their terraced structures was suggested by the shape of the cliff.

The Beehive houses, according to Lubbock,⁴ date from the stone age. Among the negroes of Africa they are so much used that they are recognized as characteristic of that country and people. They are found in other warm countries, as among

¹ *Ethnology*, p. 27.

² *Smith Report*, 1895; *Influence of Environment on Human Industries*, pp. 656-661.

³ *Peet: Amer. Antiqua.*, Vol. XXI, p. 318.

⁴ *Pre-Historic Times*, p. 57.

the Indians of California and the natives of the Philippines. The structure of the African huts is varied. They may be of straw, sticks, leaves, matting, says Starr,¹ "of one room or of many, large or small; crude or wonderfully artistic and carefully made. They may be permanent constructions to be occupied for years or temporary shelters for a single night; they may consist of frame work made of light poles over which are thrown mats or sheets of various materials and which after using can be taken apart, packed away and transported."

The work of constructing the shelter has generally fallen to the lot of the woman. Among the Indians the wigwam was made and put up by the women.

The women² of the Adaman Islands erect the shelter. The Malayan and Polynesian houses are built by the joint work of both sexes. The same is true for some of the negroes, the men doing the heavy work. The Eskimo snow hut is built by the men. Among the Zuni³ Indians the women regard any repairs as their part of the labor. When the house is to be erected the men lay the stone foundation and set in place the logs for the support of the roof, and do most of the heavy work, the women do the plastering.

The general idea, most common among savage races in regard to the division of labor, is that the function of the husband is that of a food-getter, and it is his duty to protect the family. That of the wife is to produce offspring. In the growth of the home woman has been instrumental in its enlargement, a true evolution from within outward. Mason⁴ observes that we are indebted to her for the oven, the chimney, and the chimney corner, the kitchen, the dining-room, the family room and the separate bed-chamber. This growth, as completed, approximates the house of civilized races.

The development of architecture has kept pace with the progress of industry in general. As man gradually emancipated himself from the struggle for mere subsistence, changed his nomadic life to the sedentary, leisure and freedom were found for the erection of better dwellings.

But far back beyond the first dwelling, when the mother erected the first shelter for her babe, began the development of sentiment, the widening out of this first narrow stream found expression even in the shelter for the young. The love for the child became wide and strong enough to include everything that was for the child's welfare.

The crude shelter came to have an element of beauty even in

¹ Some First Steps in Human Progress, p. 151.

² Mason: Woman's Share in Primitive Culture, p. 152.

³ Peet: American Antiquarian, Vol. XXI, p. 38.

⁴ Woman's Share in Primitive Culture, p. 235.

its structure and house building passed over into architecture, a history of which marks the growth of love and is a record of man's appreciation of the beautiful.

The relative importance attached to the house depends to a great extent on the climate, like the use of clothing, when absolute necessity is the test, inventive genius is equal to the emergency. The house of civilized man is characterized by symmetry of parts, and is generally considered a reflection of the state of culture of the people. Expression in architecture has found its widest vent on the side of religious emotion, and the house of worship—the abode of the gods,—has called forth the greatest effort to beautify and enlarge the religious ideas of man.

Comfort of Young. Among animals, besides the carefully prepared nest, no further provision is made for the comfort of the young. If the mother of the young ape¹ dies the offspring is adopted by some other member of the group. They are also said to express very great solicitude for their young as they carry them about with them. The fowl broods over her young and warms them from the heat of her own body. Many of the higher animals will remove their offspring on the approach of danger, and may conceal them in some place of safety. With man, a part of the labor is to prepare for the comfort of the offspring, and this is kept up until the period of helplessness is passed. One of the first provisions of comfort is that of clothing. Tyler² says that among the rudest tribes, even in hot districts, something is generally worn either from ideas of decency or for ornament. In such countries its use is so closely connected with that of ornament that it is thought to have arisen from some manner of decorating the body. In colder countries it becomes a necessity, and especially for the babe. A provision more general, and associated with that of dress, is that of the cradle. It is the separate bed set apart for the babe.

Ploss³ says that in general it is an apparatus for protection and concealment.

Mason⁴ sums up the uses of the cradle among the American aborigines as follows: "(1) It is a mere nest for the helpless infant.

"(2) It is a bed so constructed and manipulated as to enable the child to sleep either in a vertical or a horizontal position.

"(3) It is a vehicle in which the child is to be transported,

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¹ Brehm: Mammals, p. 6.

² Anthropology, p. 236.

³ Das Kleine Kind, p. 67.

⁴ Smithsonian Report, 1887; Cradles of the Amer. Aborig., pp. 161-212.

chiefly on the mother's back by means of a strap over the forehead, but frequently dangling like a bundle at the saddle bow. This function of course always modifies the structure of the cradle, and indeed may have determined its very existence among nomadic tribes.

"(4) It is indeed a cradle to be hung upon the limbs to rock, answering literally to the nursery rhyme :

Rock-a-bye baby upon the tree top,
When the wind blows the cradle will rock,
When the bough bends the cradle will fall
Down will come baby, and cradle, and all.

"(5) It is also a playhouse and baby jumper. On many, nearly all, specimens may be seen dangling objects to evoke the senses, foot rests by means of which the little one may exercise its legs, besides other conveniences anticipatory of the child's needs.

"(6) The last set of functions to which the frame is devoted are those relating to what we may call the graduation of infancy, when the papoose crawls out of its chrysalis little by little, and then abandons it altogether. The child is next seen standing partly on the mother's cincture and partly hanging to her neck or resting like a pig in a poke within the folds of her blanket."

What was the primitive form of the cradle?

Ploss¹ thinks that there are two different varieties that may be pointed out as original types. One is the round basket, perhaps of wicker, and the other is the hammock cradle. Many people possess only the first form others the second while some have both. The nomadic tribes—given over to the hunt or chase—or tending flocks, have only sacks or pockets, as the Hottentots, for example. The Brazilian² Indians place the new-born child in a bed of cotton material, or a hanging cradle, and it is hung up in the open air. The Dyaks³ of Borneo hang the child up in a mat. The hanging⁴ mat is used among the Russian peasants, in Trans-Caucasia, Asia Minor, to Persia. Among the Persians there is, sometimes, two posts set up for the reception of the swinging cradle. Some other people that use the hanging cradle are some of the North American Indian tribes; some tribes of Africa; Armenians, and some Slavic peoples.

The varieties of cradle in use among the Indian tribes are widely diverse. The cradle board or frame beautifully illus-

¹ Das Kleine Kind, p. 72.

² *Ibid.*, p. 73.

³ *Ibid.*, p. 74.

⁴ *Ibid.*, p. 76.

trates Bastian's study of "great areas" says Mason,¹ in that it is the child of geography and of meteorology, "In the frozen North the Eskimo mother carries her infant in the hood of her parkie whenever it is necessary to take it abroad. If she used a board or frame the child would perish with the cold." Then we have the southern limit for the frame as northern Mexico. The Eskimo has an enlarged hood for the child. The birch bark cradle is found among some Alaskan and Cape Breton tribes, "the² trowel-shaped cradle of the Oregon coast; the wicker cradle of the Hupas; the Klamth cradle of wicker and rushes; the Pomo cradle of willow rods and wicker work, with rounded portion for the child to sit in; the Mohave cradle, with ladder frame, having a bed of shredded bark for the child to lie upon; the Yaqui cradle of canes, with soft bosses for pillows; the Nez Percé cradle-board with buckskin sides, and the Sahaptian, Ute, and Kootenay cradles which resemble it; the Moki cradle-frame of coarse wicker with an awning of dressed buckskin; the rude Comanche cradle made of a single stiff piece of black-bear skin; the Blackfoot cradle of lattice-work and leather; the shoe-shaped Sioux cradle, richly adorned with colored bead-work; the Iroquois cradle (now somewhat modernized), with 'the back carved in flowers and painted blue, red, green and yellow.' " The cradles of the North American Indians are thus somewhat summed up by Dr. Chamberlain. The significant feature of the cradle, especially among peoples above the nomadic state, is its adaptation for a swinging or rocking motion. The sensation of motion has a soothing effect on the tender skin of the babe, and the motion of the cradle tends to shift the pressure to different parts of the body and thus lessen the feeling of pressure. The "sensation of motion is a pleasure-giving sensation" says Kline,³ "that has not been sufficiently analyzed." However it may point to lower levels of life, and be the expression of the long ages of struggle for existence, especially where life depended on swiftness, alertness and activity.

More recent people have connected with the cradle some curious superstitions. In Holland,⁴ rocking an empty cradle is thought to be injurious to the infant and a prognostic of its death. In Sweden, it is thought to make the child noisy and given to crying if the empty cradle is rocked. In Durham and Yorkshire it is ominous of another claimant for that place.

The Sioux woman carries her empty cradle, or keeps it in

¹ Report, Nat'l Museum, 1887, p. 162.

² Chamberlain: *The Child and Childhood in Folkthought*, p. 123.

³ *Migratory Impulse*, *Amer. Jour. Psy.*, Vol. X, p. 62.

⁴ Henderson: *Folk-Lore of the Northern Countries*, p. 19.

sight with some image in it to keep green her memory for the lost child.

In Germany,¹ there are many places at which a golden cradle is supposed to be hidden in the earth. At Schildthurm, a silver cradle was placed in the church to which unfruitful women came and rocked with the hope that they might be blessed with children.

The use of fire in the home. No one thing has marked off the human home from that of the animal more than the use of fire. The earliest remains of their dwellings show traces of its use. The cave dwelling, the kitchen midden, and the lake-dwellings have traces of the charred remains of their early food-getting habits and preparation. In fact primitive man comes to us thus armed for the cold climate and thus prepared to face new dangers and enemies. It served him as one of his chief weapons to overcome the mammoth that dared attack him. When no weapon would pierce the tough skins of the dangerous beast then the fire brand was used to frighten it away. Few peoples do not know how to produce it and none of the races or tribes² are without its use.

The aptitude of primitive man to myth and tradition to weave into his life the things most closely associated with him has made it a god, and wrapped its history in the strangest myths. It becomes for the low savage, almost a vital principle and its virtue transforms it into something mysteriously pure. It is no doubt associated with the sun above and the volcanic action below. The Parsees³ of India still holding on to the old Persian religion are worshippers of fire. In times past the Brahmans, Ghebers, Peruvians, Hindoos, and Romans, among many others, have either worshipped it or given it a place in their religion. Both in time and space the custom has been widespread,—finding place among the Chaldees, Hebrews, Greeks, Romans, Peruvians, and Mexicans, either in their religious or funeral customs.⁴

The Zend Avesta forbids putting anything unclean into the fire and no indecent act is to be committed before it.

In Albania⁵ it is an unpardonable offence to spit in the fire.

Heraclitus in his attempt to find the abiding substance declared that the world was an "ever-living fire" and that fire was the essence of all things. There have been many strange myths as to its origin. The Australians⁶ say that a selfish

¹ Ploss: *Das Kleine Kind*, p. 102.

² Tyler: *Early Hist. of Mankind*, p. 235.

³ Deniker: *The Races of Man*, p. 219.

⁴ Joly: *Early History of Fire*, *Pop. Science Mon.*, Vol. IX, p. 17.

⁵ Reclus. *Enc. Brit.*, *Fire*, p. 230.

⁶ Joly: *op. cit.*, p. 21.

little bandicoot owned the first firebrand, and that it was gotten from him only after a council of war had been held by the other animals. It was then handed over to man. The Peruvians¹ say that the sun,—the wife of the moon—fell down to the earth once, and was helped up again by an Indian, the second time it fell down it set the forest on fire.

The New Zealanders² trace the origin of fire through Maŋinke,—an old blind woman who lives in the lower regions. It was only after she had been threatened with death would she share her treasure. Among these people “no fire is allowed to be kindled at night in the houses of the people all the year round. It is sacred to the god, and so after sundown they sit and chat in the dark.” With the Kaffirs every religious ceremony must be performed in front of a fire. “In the Rig Veda³ the crackling of the blazing twigs is regarded as the speech of the gods, just as it is to-day in Borneo.” The Legend of Prometheus, according to Tyler,⁴ has a close connection with the old Brahmin *pramantha*; *i. e.*, the spindle for making fire, and the symbols used for it are identical with those for reproduction.

The Roman temple Vesta⁵ had no other goddess for worship except the vestal fire that was kept burning. If this by chance was extinguished all business ceased. The connection between heaven and earth had been broken.

Survivals of fire worship are to be found in the “new fire” ceremonials. Brinton⁶ says “we have but to enter a church of the Roman communion on the morning of Holy Saturday to witness the impressive ceremonies with which the creation of the ‘new fire’ is to this day celebrated in our midst.”

The instances given show the great rôle that fire worship has played among primitive peoples. When it was brought into the home it was like the advent of the gods, and the early primitive hearth was a place of worship. It was a living thing and no doubt the resemblance of the dying embers to the ebbing spark of life wrapped up its life more completely in that spirit world, which plays so great a part in savage welfare.

The hearth or family fireside is a tie that binds the members together. “All Greece confederated making Delphi its central hearth, and the islands congregated around Delos, whence the new fire was fetched every year.”

The prytaneum was the common hearth for the city. On

¹ Tyler: Prim. Cult., p. 288.

² Tyler: Early Hist. of Mankind, p. 231.

³ Brinton: Relig. of Prim. Peoples, p. 142.

⁴ Anthropology, p. 396.

⁵ Reclus. Enc. Brit., Vol. IX, p. 229.

⁶ Religion of Prim. Peoples, p. 142.

this there burned a perpetual fire. It was sacred to Hestia, the personified goddess of the hearth.¹

The family tie, linking one member to another, grows up around the fireside. It is the meeting place where tradition and custom are passed along from generation to generation. The savage here related his encounter with this animal and his narrow escape from that one; all their traits and peculiarities were given crude anthropomorphic significance. Old traditions of monsters; the story of the brave warrior, legends of animals, spirits, etc., were here related. In this way the fireside was the school.

So much of primitive, savage, and even civilized life is spent around the fireside, that some accumulated effect, if such can happen, has certainly grown up with its associations, and we prefer to be around the open fireside. Dr. Hall² collected data in regard to fear of fire, and in his article says, "Traces of the charms of these old associations are abundant in child-life as other returns show. Just to idly gaze at fire now starts dreamy reveries, veined through which are traces of very primeval yet earnest thinking. It stimulates memory and story. . . . The very play of form and color half hypnotizes and autonomizes the mind, and as we see solid matter volatilize to smoke there seems some mysterious power within and behind it all."

Food. The conformation of the digestive system and the dental arrangement in man indicate that at some period he was frugivorous. War and migration tended to widen his habitat, and from necessity he became omnivorous in his diet. With the advent of the use of fire in the preparation of food came a great advance. Tribes that cook food are more enterprising and energetic than eaters of raw meat.

Cooking lessens the amount of food required and is a saving of energy. It has further enlarged man's dietary to include foods either poisonous or unpalatable in their raw state.

Roasting or broiling is the one process that is most universal. The Adaman³ Islanders keep the fire smouldering in hollow trees so that they only have to clear away the ashes to broil their fish or pigs. The Tasmanians⁴ neither skinned nor disemboweled animals before cooking, but placed them whole on the fire. The ant hills were cleaned out by some of the African⁵ tribes and a fire built within the pit, when this was removed the rhinoceros joints were roasted in the temporary oven. Slight variations among other tribes, as those of Madagas-

¹ Joly: Enc. Brit., Vol. IX, p. 230.

² Study of Fears, *Am. Journal of Psy.*, Vol. VIII, p. 181.

³ Tyler: Early History of Mankind, p. 261.

⁴ Mathew: Eaglehawk and Crow, p. 28.

⁵ *Ibid.*

car, South Sea Islands and tribes of Polynesia, were to place hot stones on the food to be roasted.

The Chinese legend, as set forth by Charles Lamb, is that roasting of meat came about by the accidental burning of a building. In order to have roast pig it was necessary to burn down the building. The Assiniboin Indians practice stone boiling by digging a shallow pit and lining it with the hide of some animal which they have slain, as the buffalo. Water and the food to be boiled is placed in this and then heated stones are dropped in.

The different methods of cooking by different races show steps of advancement.

Starr¹ thinks the steps in the growth of cookery have been: first, "roasting or parching; then came baking; then broiling." Parching of grains is common among most peoples.

A few races yet in their degradation, and especially in times of severe need, will resort to the lowest forms of life for food.

The Australians² will make a meal on fish, bats, frogs, lizards, snakes, or worms.

The Malayan³ tribes, the Bushmen, Pigmies of Africa, and the Fijians are degraded in their diet.

With domestication of animals comes an advance in the quality and permanence of the food supply. With agriculture the permanence of the habitation. The savage who depends on an irregular food supply can never comprehend regularity, and, says Buckles,⁴ his irregularity "would prevent him from suspecting anything like method in the arrangement of nature, nor could his mind even conceive the existence of those general principles which govern the order of events."

Regularity in work has given rise to regularity in meal time. According to Pavy,⁵ "Carnivorous animals apparently thrive best when fed at long intervals; herbivorous, when they are constantly eating; man being omnivorous, his food should be taken at intervals of much less duration than the carnivora."

One of the first advances in the evolution of the meal-time is found in the communal home.

There one meal is prepared each day for the household. Such was found among the Iroquois,⁶ and the Spaniards found an elaborate dinner prepared each day in Montezuma's Castle.

¹Some First Steps in Human Progress, p. 32.

²*Ibid*, p. 31.

³Hutchinson: Living Races.

⁴Influence of Food on Civ., N. A. Review, Vol. CXXXV, p. 548.

⁵A Treatise on Food and Dietetics, p. 510.

⁶Morgan: Houses and House Life of Amer. Aborigines, p. 101.

The change from the apparent freedom of the savage to that of the fixed rules and customs of society is somewhat difficult.

Morgan¹ mentions a Seneca chief, whose daughter had been educated in the usages of civilized life, who desired the usual food constantly prepared ready to offer any person who entered their house, "saying that he did not wish to see the custom of their forefathers laid aside," although they had adopted the regular meals of civilized society.

In the effort to get food, the water is looked upon as the place of least effort. The lake dwellers built their huts over the water, and could count on its supply for food. And for many tribes it is a natural reservoir. Morgan² thought that the principal reliance of the American aborigines was on fish. That "they were in reality from first to last, nations of fishermen, who eked out their scanty sustenance with game, natural fruits, and bread roots, and afterwards—a portion of them—with the products of a limited agriculture."

The Athapascans and Ojibways subsisted almost entirely on a fish diet while the Aztecs and Thascalans subsisted chiefly on vegetable food. The other tribes were intermediary in their diet between these extremes.

He further divided mankind into five³ classes depending on their foods. The lowest class are those who have a natural subsistence of fruits and roots and are restricted to a more or less definite habitat. The second class are those subsisting on fish, the third class by means of cultivation have a farinaceous subsistence; the fourth class are those subsisting on meat and milk, and the fifth class are those having an unlimited subsistence through field agriculture.

These are in fact steps marking the subsistence of many of the existing peoples.

The influence of food on the individual in the different stages has been often noticed, and the best labor and results are gained by having the best and greatest variety of food. The dwarfed stature of the Bushmen, goes well with his degraded habits, and the food of the Eskimo leaves a smaller margin for growth after the heat for an arctic climate is set free.

Some foods have been esteemed especially virtuous. Honey has been regarded as having great virtue because of its near relationship to the nectar of the gods. Dr. Chamberlain⁴ has collected some information in regard to the food of children and its relations to the gods.

Among the Friesians and Germanic tribes the child could

¹ *Op. cit.*, p. 46.

² Beach: Indian Miscellany, p. 164.

³ Ancient Society, p. 19.

⁴ The Child and Childhood in Folk-thought, pp. 145-151.

be exposed, or put to death, so long as it had not taken food, "but as soon as the infant had drunk milk and eaten honey he could not be put to death by his parents." In Iceland, in ancient times, "the food of the suckling was sweetened by honey."

Among the Germans, Greeks, Slavs, Hindoos, etc., milk and honey have been esteemed the food of the gods. These were the first foods for the child and we have the first step in the external relationship of the child-life to the god-life beyond.

When fire came into the home as a living deity that watched over and assisted the family, its use to prepare food made it the chief center around which the family gathered, and around it they partook of their meals, after having first offered a sacrifice to it. "The hearth," says Keary,¹ "was to each member of the household as it were an *umbilicus orbis*, or navel of the earth." But this holds true no less to-day for all peoples and classes. The strongest and most fundamental desire is that for food, and all civilized races instinctively look to the fireside as a sort of birthplace of food. The change from the state of natural subsistence to that of cooked food has been attended with no disaster to the race while, on the other hand, it has been the greatest of economic achievements,—the *sine qua non* for present civilization.

Some animals, as the ant, a few birds, the squirrel, the bee, have the art of preserving foods for winter; some, as the bear, and woodchuck, live through the winter upon the fat stored up, but the great majority of animal life keep up the ceaseless struggle for subsistence. The cheek pouches of squirrels, monkeys, gophers, mice, etc., are excellent adaptations for carrying food. The social stomach of the ant, as Forel² calls it, is another adaptation for storing and preserving food. It is also a factor that contributes to perfect their life for societies. In cold countries, insect-eating animals pass a quiescent state during the winter corresponding to the winter sleep of the insect, or in warm countries a period of aestivation.

Wesley Mills³ has made a study of hibernation among animals, and especially that of the American marmot. He divides the life of this animal into four periods; (1) "A period characterized by either drowsiness or sleep or profound torpor, lasting from about November to April. (2) A period of perfect wakefulness immediately following, during which the animal was emaciated, in poor coat, and with a general low vital

¹ The Dawn of History, p. 145.

² The Social Life of Ants, Int. Monthly, May, 1902.

³ Animal Intelligence, p. 83.

capital, lasting for some weeks. (3) A period of improving condition, with good health and a desire to get free, which latter was also noted in the preceding period. (4) A period of maximum weight and vigor with perfect coat and an abundance of fatty tissue." This may perhaps be taken as the maximum of the winter sleep among mammals; among the amphibia it is more profound; while some animals present a less profound sleep, grading off to a period of drowsiness during the coldest weather.

The dwelling place of man is usually a storehouse for food. Home and food have grown up together and either word has come to imply the other.

The effect of food. The over-fed plant has been observed to produce an abundance of foliage, but little fruit. Spencer¹ thought that among social insects the sex was determined by the degree of nutrition while the eggs were being formed, other differences in structure among them being determined by the character of the food during the larval stage.

Among different insects it has been noted that during the summer, when food is plentiful, a predominance of females is produced, but on the approach of autumn, when food is scarce, more males are produced. Yung's² experiments on tadpoles was to the effect that when they were left to themselves the proportion of females was about fifty-seven in a hundred. Of three broods tried, the first fed with beef, increased the number of females to seventy-eight in a hundred; the second fed with fish brought the percentage up to eighty-one females in a hundred, and the third, fed with the flesh of frogs, produced ninety-two females and eight males in a hundred.

Ploss first noted the relativity of the births, as to sex, in Europe, and observed that when the harvests were poor more boys were born than girls. On this basis, Schenk³ has endeavored to establish his theory of sex, believing that poverty of the harvest led to more of a meat diet, and that, therefore, is a factor for producing masculine offspring. He further believes that if he can control the diet for a period of three or four months previous to conception, he can control the sex. The economy of nature, in response to an over-abundance of food, would be an excess in the number of fertile females, tending to increase the number of that species to its food-limit.

Growth of the social instinct. The thread of love that kindled in the mother's breast of some low type of life widened in different directions, but first of all it was imparted to the offspring.

¹ Contemporary Review, Dec., 1893, p. 11.

² Geddes and Thomson: Evolution of Sex (quoted), p. 41-52.

³ Determination of Sex, p. 221.

It grew from generation to generation until self-hood was recognized in like type and sociability made possible. This social instinct, if we may so call it, is found among the lowest forms, and may even have had its birth in the animal colonies, as the polyp or coral. But many of the free swimming marine forms of the same species unite in great number for search of food. Bluefish, salmon, herring, shark, cod, etc., travel and live in shoals. Insects migrate in swarms, as the locust, or butterfly; or live in colonies, as termites, ants, or bees. Birds, as terns, sea gulls, penguins, swallows, quail, crows, buzzards are sociable, and those that migrate collect in large numbers; even different species associate at this time¹. Mammals, as deer, elephants, buffaloes, monkeys, live in herds; or horses, cattle, and sheep, in droves; or beavers and prairie-dogs in colonies. In fact, as Krapotkin² says, it is easier to name the exceptions among animals that do not live in associations of some kind than those that do. The cat tribe practically being the only exception. The teaching of Darwin was that "the struggle for existence" is inclusive and covers the whole field of animal life, activity and endeavor, and that associations of animals, of whatever kind, while they find pleasure in society and escape many dangers, is merely to carry on this warfare in a wider and a more perfect condition. But the fittest are also the most sociable animals, and sociability appears as the chief factor of evolution both directly by securing the well-being of the species while diminishing the waste of energy, and indirectly by favoring the growth of intelligence. Espinas, in his valuable contribution to the study of animal societies recognizes two kinds of social relations: (1) The organically connected colonies of animals, as the coral, (2) those associations whose origin is found in the desire for reproduction. The period of association varies in different animals, but for the higher vertebrates the existence of permanent bands and organizations becomes more frequent, and serve wider purposes.

Another condition of animal life now generally recognized by students of sociology is termed animal marriages. It represents the period that the male and the female of any one species live together. This may be for life as it is thought to be the case among some birds, as the bald eagle.³ Among other species of birds it is kept up for one or more seasons. Since most of the birds live in pairs, Snider⁴ recognizes in these unions the "first decisive instances of monogamy in nature." The mammals present less sharply defined traits for pairing

¹ Krapotkin: Nineteenth Century, Sept. and Oct., 1890.

² *Ibid.*

³ Audubon: Birds of America, Vols. I & II, p. 60.

⁴ Social Institutions, p. 124.

and many of them, while sociable, exhibit only a common interest in the welfare of the herd. They are for the most part, as the seal and many of the monkeys, polygamous. The higher apes and the gorilla, simang and orang-outang, show decided tendencies to live in pairs,¹ and to continue the family relation in bands after the young are matured.

The social nature of the animal, as thus briefly set forth, and his so-called marriage state, sets before us the basis for the social nature of man and the possibility of the permanence of the human marriage relations.

The social nature of the animal has found its supremacy in man, and the imperfect and irregular marital relations have found their permanence in the family. Marriage and family have grown up together, the permanency and the duration of the length of the union depending on the helplessness of the young, and the amount of care needed. No definite time, as the limit of the marital relations, could be adopted and no state of promiscuity as is now generally disregarded by recent writers, would be compatible for the proper care of offspring. The marriage relations is a growth from within outward, radiating ever about the one central point, the best preparation of the young to meet the requirements of the environment and to propagate the species.

Origin of marriage. Whatever may have been the form of primitive marriage is yet uncertain. Several of the older writers, as Morgan, Bachofen, and Lubbock, who made studies of primitive peoples, thought that a period of betairism was the primitive state. But the prevailing opinion now, as shown by the works of Westermarck, Letourneau, Deniker and others, is that at no time was this custom prevalent to any great extent, and is not known to be practiced by any tribes² exclusively. The argument for this belief was based on the writings of Heroditus, Strabo, and Solinus, and an imperfect knowledge of the practices of primitive peoples.

Morgan³ recognized five stages of the family in his classificatory system of relationships. This was based on a study of the Iroquois, and the stages were supposed to represent the growth of the family. The first was that of the consanguine family, founded upon the intermarriage of brothers and sisters. The second was the Punalian family founded upon the intermarriage of several sisters with each other's husbands, in a group; or in general a group of men were conjointly married to a group of women. The third was the pairing family,

¹ Snider: *op. cit.*, p. 126.

² Brinton: *Religion of Prim. Peoples*, p. 201.

³ *Ancient Society*, p. 384.

founded upon the marriage between single pairs, but not exclusive, and continued during the pleasure of the parties. The fourth was the patriarchal family founded upon the marriage of one man with several wives and fifth the monogamian family or marriage between single pairs.

Bachofen¹ recognized; (1) a state of hetairism or promiscuity; (2) a matriarchate, the woman being the recognized head of the family; (3) a patriarchate, the father being the head of the family. For Sir John Lubbock,² the first state was that of communal marriage, the second was that of capture and the third was some form of exogamy.

The later writers, as Letourneau in his "Evolution of Marriage," recognizes polyandary as forming the lowest state. By capture and purchase there arose the monogamous; out of this also grew up polygamy. The highest form is that of monogamy. Westermarck³ in his exhaustive study of the family recognizes polygamy as the earliest condition of marriage; through modification this passed into the monogamous form. The second type was that of polyandry which, through various agencies, also passed to the monogamous form. The views of the older writers have become more or less discredited as more exact information of the history and life of savage peoples has been obtained. The growth of the affections and some knowledge of possession, especially in recent times of property values have tended more and more toward marking off the individual and defining his mode of living. The basis for the marriage relation Letourneau⁴ attributes to biological forces. "The institution of marriage," he says, "has no other object than the regulation of the sex unions." Others take a wider view and place on a more or less equal basis psychological, biological and social forces. Starcke's⁵ conclusions were that a man connects himself with a woman in order that she may work and keep house for him, since as he thinks there was an early division of labor between man and woman, and second, that they may obtain children. The desire for children that he may live on through them and that they may be a support for him.

The development of courtship even among animals has a sufficient history to show that many psychic elements find expression in display and arts of various kinds. The extremes which this has taken among some animals is a proof that winning on the part of the male and selecting on the part of the

¹ Das Mutterrecht.

² Origin of Civilization, Chap. III.

³ The History of Human Marriage.

⁴ The Evolution of Marriage, p. 3.

⁵ The Prim. Fam. in its Origin and Devel., p. 256.

female have been unconscious educating factors. Espinas¹ recognizes five kinds of intermediaries that are effective in sexual selection. They are: touch, smell, color and form; noise and tone; and play and motion. The mental effect of these play an important rôle among different animals. When all the factors are considered we cannot help but conclude that the psychic and social as well as the biological forces have all been important in the growth of marriage; the first two being the perfecting elements.

The Growth of Love. The female insect selects the place to deposit her eggs, the male, often insignificant yet necessary, may or may not attend her. The female fish selects the spot to deposit the spawn; this is true, with but a few exceptions, for the great body of fish life. Most nests are built by the female bird and only among the highest types does the male assist in the labor. Among mammals the female usually selects the site for the home. The female rabbit digs the little burrow in which her young are brought forth. Wherever the preparation for offspring is made the female takes the initiative. The human female, says Mason,² "more than all the rest created her home."

The females are smaller among many of the cephalopods³ and some of the cirripods. Most female annelids are larger and certain articulates. The queen bee, hornet, and wasp are larger. Female butterflies are also larger than the males. The female of many fishes are larger, as in the cyprinoids, and also among reptiles. In nearly all birds and among all higher vertebrates the male is larger. As to the nurture of the young animals in general, Mrs. Blackwell⁴ says, "no male of any species high or low is known to afford direct nutriment to the young—to first assimilate the food and then transfer it to the offspring," while the female always affords direct nurture. Women are considered less variable than men. They depart less from childhood in shape and disposition. Her thoughts are impelled by her feelings. Ellis⁵ has observed that in males generally "there is an organic variational tendency to diverge and to progress, while in woman there is an organic tendency to stability and conservatism involving a diminished individuality and variability." Woman is further characterized as anabolic, to store up a reserve for the future need of offspring; while man is catabolic. They are longer lived than men and

¹ Die Thierischen Gesellschaften, p. 270.

² Woman's Share in Prim. Culture, p. 234.

³ Delauney: Equality and Inequality in Sex, Pop. Science Mon., Vol. XX, pp. 184-192.

⁴ Sexes Throughout Nature, p. 29.

⁵ Man and Woman, p. 369.

more resistant to certain diseases, the variability¹ of man being accounted a sufficient basis for more marked pathological characteristics. Ellis² thinks that the longer life of woman marks the necessity for the care of the young.

Schäffle³ pointed out the mental differences of the sexes. He characterizes woman as attaching her interest to the special and the individual, to the curious and the beautiful isolated phenomena. "It is feminine to desire to occupy with the whole personality a restricted sphere and to work in it with the most intense affection." The chief difference between the sexes, he thinks, resides principally in the feelings.

These distinctions, as above noted, represent some of the characteristics of the female. In part they have been instrumental in the development of the mother. The growth of love is a long history. The lowest forms are totally indifferent to kind or offspring; the gradual growth of inclination to care for eggs, to place them, to protect them, to incubate them; or if viviparous the offspring may depart unnoticed by the mother. No opportunity is given for the slightest responsive spark in its life. The real attachment between mother and offspring begins in the animal series when the mother begins to supply food, whether consciously or not, directly to the offspring. In the process of evolution, the supplying of food, at times, and even in the life of a species, may have existed as a reflex act. But if this were so when the object of her labors were removed, the habit so peculiar to the organism of the mother would be broken, and if it were possible this would awaken consciousness, if not of the loss of progeny, at least to a change of habit. Given the spark of attachment between mother and offspring, the flame has widened as though it were a great vantage field—which it really is—in the evolutionary process. A factor so useful that it has constantly tended to reduce the number of progeny necessary to carry on the species. With greater exertion of the parent, and a longer period of care has come greater opportunity for the growth of the bond uniting mother and offspring. Not only food and protection come to be provided by the mother, but comfort in different ways. These represent enlargements of the bond of sympathy as emanating from the parent. They also provide a wider field of stimuli calling forth a like response in the offspring. So in general the growth of the bond of affection between parent and offspring has increased *pari passu* with the amount of attention exercised by the mother.

¹ Ellis: *Man and Woman*, p. 369.

² *Ibid.*, p. 384.

³ Small and Vincent: *Study of Sociology*, p. 180. (Summarized.)

The theme on which Drummond¹ wrote so beautifully was the evolution of the mother. The highest expression of which is found among civilized men. Characterized by patience, sympathy, carefulness, and devotion, she becomes the perfect "tutor of the affections."

The period of infancy was pointed out by Fisk² as having a wide meaning in the evolution of the race. He thinks that while this alone makes possible the education of the sentiment of love, it has also created man's social nature, and fits him for living in societies. A few instances will point out the significance of this period. The offspring of the ungulate or hoofed animal is able to walk almost as soon as born. The weasel or the badger³ are blind for a fortnight after birth and stay with the mother for two months or more.

According to Wallace⁴ the orang-outang attempts to walk at the age of about one month, and lifts itself up by holding to objects. Previous to this time it lies on its back, helpless, rolling from side to side. It tries to grasp but is scarcely able to guide its fingers. The babe, the most helpless of all young, begins to walk at from twelve to fifteen months, and needs at least eight years of care. The brain, according to Sharpley,⁵ on the average, weighs fourteen ounces, while the weight of the entire body of the infant on an average is six and one-half pounds. Yet with this proportion of one-seventh of the organism as brain weight the infant at birth is far behind the ungulate in the ability to even survive. The marsupial young are brought forth at a very immature stage, and the external development is completed in the pouch with which the mother is provided. The period of gestation for the herbivora is much longer than for the carnivora of equal weight. The gestation period for a wolverine⁶ and a sheep, of approximately the same weight are respectively 90 and 150 days, yet the lamb may be able to walk a few moments after birth, while the wolverine young are helpless. The significance of the nest becomes apparent. The longer period of gestation in the one case has developed the nervous system to such a stage that the instincts are ripe to assert themselves. The kangaroo transfers, as it were, its womb to the exterior part of its body. The undeveloped nervous system here completes its growth. For the mammal the nest serves a similar device; for man it is the home.

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¹ *The Ascent of Man*, p. 267, *et seq.*

² *Cosmic Philosophy*, p. 343.

³ Sutherland: *Origin and Growth of the Moral Instinct*, Vol. I, p. 90.

⁴ *Ibid.*, p. 96.

⁵ *Ibid.*, p. 82.

⁶ *Malay Archipelago*, p. 35.

The period of helplessness is the opportunity for the mother. Her fund of feeling finds expression in a thousand ways. Scott¹ thinks that care for the young "grows out of the care of the individual for its own body, and that the offspring which has been for a time a portion of herself, is defended by the mother with a fervor which arises almost directly from the interest of self-preservation."

Among some animals care may be prompted by a desire to get rid of the uneasiness caused by overburdened udders. "The unrelieved pressure in the mammary gland of a mother animal robbed of her young," says Geddes and Thomson, "is no doubt largely concerned in prompting her to adopt young ones not her own."

In regard to care, and especially the period of infancy, Fisk² noted that in general the "duration of the feelings which insures protection of the offspring is determined by the duration of the infancy."

Responsive expressions are peculiar to childhood and especially among girls. Children's games and plays are manifestations full of the growing affections. Dr. Chamberlain³ has summarized some of the playthings among different peoples. This shows how widely dolls are used by children. The "Study of Dolls," by Dr. Hall,⁴ brings to light an unfolding process in child-life. The food they are supposed to need; the names for them; the need of sleep; the sickness, the death, the funeral, the burial; these may be taken as expressions of growing sentiment that have developed in response to the mother's care.

Kline⁵ in his study of migration cites the following as some of the factors making for love of home, as shown by questionnaire returns.

(1) F., 19. "I think that the order is mother first, father and brother equally. I love to think of my surroundings at home in this order: the sitting-room, the two maples in the yard, the brook and the surrounding hills."

(2) F., 20. "The elements in my own love of home are first my father, then sister, brothers, the house, and familiar spots on the farm."

(3) F., 17. ". . . . Father and mother and next my sister and brother . . . then the home feeling which I have but which I cannot possibly explain."

Forecast. The number of offspring has constantly shown a decrease with the growth of love and care for them. But this

¹ Sex and Art., *Amer. Jour. Psy.*, Vol. VIII, p. 171.

² Cosmic Philosophy, p. 343.

³ The Child in Folk-thought, p. 216.

⁴ *Ped. Sem.*, Vol. IV, pp. 129-175.

⁵ *Amer. Jour. of Psy.*, Vol. X, p. 66.

has not ceased with the progress of civilization. Indian women have rarely more than four or five children. Westermarck¹ thinks this holds good not only for the North American Indians, but, upon the whole, for a great many uncivilized peoples. Among civilized peoples increased responsibilities imposed by high standards of living cause a decrease in the number. In the United States,² for the year 1850, the average size of the family was 5.94 persons to each dwelling in the country, while for 1890, there were 5.45 persons. This shows a decrease for the entire country, but for the urban population alone the decrease is much more marked than for the rural population.

The country in which the decrease is most noticeable is France³, where the ideal family consists of two children. The desire of the parents is that the marriage dowry may be sufficient for comfortable living. This is especially true for the agricultural class, the family consisting of a boy and a girl, the income from the respective dowries received will not be reduced below that of the parent.

Among infants the death rate is very great, more than ten per cent. of them dying before they are one year of age. Among savage races this is especially large. Pava has noted the inadaptability of the child for digestion. The alimentary canal is short, and no saliva is present. The food of the mother and the newly born child should be the best. This is often poor among savage races, and the hardships are often extreme. The improved condition of home life has had its effect in bringing better sanitary conditions. Wright⁴ says "It must be conceded that if a decrease in infant mortality is the result of more concentrated care upon the few, then the smaller family is more effective in society than a large one neglected. Certain it is that the average duration of human life has been increased at least ten per cent. under modern civilization."

Of the three elements of the mind, feeling and sympathy are primordial in their development. These are the characteristics of motherhood. Modern civilization, with the great store of tradition and learning, impose new conditions on the individual. Cognition tends to be supreme and feeling the virtue of femininity is subordinated. The conditions of true motherhood are imperiled by the transition from the sphere of feeling and emotion, to that of cognition. The question raised by Griggs⁵ is whether the biological basis of human existence is a sufficient

¹ The History of Human Marriage, p. 491.

² Wright: Outlines of Sociology, p. 42.

³ Demolin: Anglo-Saxon Superiority, p. 94.

⁴ *Op. cit.*, p. 68.

⁵ The New Humanism, p. 213.

foundation for the vast superstructure of life. Higher education of women brings this danger to the home.

Another danger that Bryce¹ thinks higher education brings for the home is individualism. That is the desire of each person to do what he or she pleases, to gratify his own or her own tastes, likings, and caprices; to lead a life which shall be uncontrolled by another's will. The nervous system grows more irritable, he thinks, and there is greater friction, and for this reason temper is a growing cause of menace.

Wake² notes, also, "that as a result of the development of the intellectual faculties which constitute the chief element in individuality, the desire to escape the cares of a family may lead to disinclination for marriage, if even there is not a repugnance to it." Carpenter³ in reflecting on the course of evolution and the voluntary sterility of certain classes of society women, remarks that "sometimes it seems possible that a new sex is on the make—like the feminine neuters of ants and bees—not adapted for child-bearing, but with a marvellous and perfect instinct for social service, indispensable for the maintenance of the common life."

In regard to society as a whole it tends more and more to the feminine type. The community of savage⁴ life approaches the masculine, selfish, unstable, variable. With no fixed abode they roam about from place to place, killing and destroying; warfare is their glory. Woman's influence comes to exert itself to a greater extent with the growth of civilization. Who can estimate the effect of the female teacher in the schools, in helping to civilize the race and in bringing to compromise the variable nature of man? It is like an extension of motherhood, throughout all the earlier years of life. In regard to the duration of life, Weismann's idea is to the effect that the increase in length is exactly proportional to the time which is demanded by the care of the young. With the development of civilization new conditions are imposed upon the young, these require a longer period for preparation and tend to increase the period of helplessness. Corresponding to this we should expect an increase in the length of life, which as above noted we find. If from this brief study of the conditions of home we should venture any forecast as to the course of the evolutionary process, the evidence would seem to indicate that whatever infinitely small changes are taking place in shaping the destiny of the race no small amount of this force lies along

¹ *Studies in History and Jurisprudence*, Vol. II, p. 463.

² *Sociology—Brooklyn Ethical Asso.*, p. 69.

³ *Love's Coming-of-Age*, p. 67.

⁴ *Morley: Life and Love*, p. 200.

lines that tend to the care and comfort of the race. The influence of the mother is yet a great factor in progress.

The writer desires to acknowledge his indebtedness to President G. Stanley Hall, under whose supervision this work was done, for many valuable suggestions, and much of whatever merit it may contain is due to his wise counsel. He also desires to thank Dr. Sanford and other members of the faculty of Clark University for their kind assistance.