8 **Rapid #: -5249578**

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CALL #: **Shelved By Title**
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TYPE: Article CC:CCL
JOURNAL TITLE: The Nineteenth century.
USER JOURNAL TITLE: The Nineteenth century
COC CATALOG TITLE: The Nineteenth century
ARTICLE TITLE:
ARTICLE AUTHOR: Mutual Aid among Animals
VOLUME: 25
ISSUE:
MONTH: nov
YEAR: 1890
PAGES:
ISSN: 2043-5290
OCLC #: 1780286
CROSS REFERENCE ID: [TN:163499][ODYSSEY:206.107.42.207/ILL]
VERIFIED:

BORROWER: **HDC :: Honnold Mudd Library**
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MUTUAL AID AMONG ANIMALS.

(*Continued.*)

As soon as spring comes back to the temperate zone, myriads and myriads of birds which are scattered over the warmer regions of the South come together in numberless bands, and, full of vigour and joy, hasten northwards to rear their offspring. Each of our hedges, each grove, each ocean cliff, and each of the lakes and ponds with which Northern America, Northern Europe, and Northern Asia are dotted tell us at that time of the year the tale of what mutual aid means for the birds; what force, energy, and protection it confers to every living being, however feeble and defenceless it otherwise might be. Take, for instance, one of the numberless lakes of the Russian and Siberian steppes. Its shores are peopled with myriads of aquatic birds, belonging to at least a score of different species, all living in perfect peace—all protecting one another.

> For several hundred yards from the shore the air is filled with gulls and terns, as with snow-flakes on a winter day. Thousands of plovers and sand-coursers run over the beach, searching their food, whistling, and simply enjoying life. Further on, on almost each wave, a duck is rocking, while higher up you notice the flocks of the Casarki ducks. Exuberant life swarms everywhere.[1]

And here are the robbers—the strongest, the cunningest ones, those 'ideally organised for robbery.' And you hear their hungry, angry, dismal cries as for hours in succession they watch the opportunity of snatching from this mass of living beings one single unprotected individual. But as soon as they approach, their presence is signalled by dozens of voluntary sentries, and hundreds of gulls and terns set to chase the robber. Maddened by hunger, the robber soon abandons his usual precautions: he suddenly dashes into the living mass; but, attacked from all sides, he again is compelled to retreat. From sheer despair he falls upon the wild ducks; but the intelligent, social birds rapidly gather in a flock and fly away if the robber is an erne; they plunge into the lake if it is a falcon; or they raise a cloud of water-dust and bewilder the assailant if it is a kite.[2] And

[1] Syevertsoff's *Periodical Phenomena*, p. 251.
[2] Seyfferlitz, quoted by Brehm, iv. 760.

while life continues to swarm on the lake, the robber flies away with cries of anger, and looks out for carrion, or for a young bird or a field-mouse not yet used to obey in time the warnings of its comrades. In the face of an exuberant life, the ideally armed robber must be satisfied with the off-fall of that life.

Further north, in the Arctic archipelagoes,

> you may sail along the coast for many miles and see all the ledges, all the cliffs and corners of the mountain-sides, up to a height of from two to five hundred feet, literally covered with sea-birds, whose white breasts show against the dark rocks as if the rocks were closely sprinkled with chalk specks. The air, near and far, is, so to say, full with fowls.[3]

Each of such 'bird-mountains' is a living illustration of mutual aid, as well as of the infinite variety of characters, individual and specific, resulting from social life. The oyster-catcher is renowned for its readiness to attack the birds of prey. The barge is known for its watchfulness, and it easily becomes the leader of more placid birds. The turnstone, when surrounded by comrades belonging to more energetic species, is a rather timorous bird; but it undertakes keeping watch for the security of the commonwealth when surrounded by smaller birds. Here you have the dominative swans; there, the extremely sociable kittiwake-gulls, among whom quarrels are rare and short; the prepossessing polar guillemots, which continually caress each other; the egoist she-goose, who has repudiated the orphans of a killed comrade; and, by her side, another female who adopts anyone's orphans, and now paddles surrounded by fifty or sixty youngsters, whom she conducts and cares for as if they all were her own breed. Side by side with the penguins, which steal one another's eggs, you have the dotterels, whose family relations are so 'charming and touching' that even passionate hunters recoil from shooting a female surrounded by her young ones; or the eider-ducks, among which (like the velvet-ducks, or the *coroyas* of the Savannahs) several females hatch together in the same nest; or the lums, which sit in turn upon a common covey. Nature is variety itself, offering all possible varieties of characters, from the basest to the highest: and that is why she cannot be depicted by any sweeping assertion. Still less can she be judged from the moralist's point of view, because the views of the moralist are themselves a result—mostly unconscious—of the observation of Nature.

Coming together at nesting time is so common with most birds that more examples are scarcely needed. Our trees are crowned with groups of crows' nests; our hedges are full of nests of smaller birds; our farmhouses give shelter to colonies of swallows; our old

[3] *The Arctic Voyages of A. E. Nordenskjöld*, London, 1879, p. 135. See also the powerful description of the St. Kilda Islands by Mr. Dixon (quoted by Seebohm), and nearly all books of Arctic travel.

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[5] Brehm Father, quoted by A. Brehm, iv. 34 sq. S
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[6] Dr. Coüs' *Birds of Dakota and Montana*, in *Bu*
iv. No. 7.

towers are the refuge of hundreds of nocturnal birds; and pages might be filled with the most charming descriptions of the peace and harmony which prevail in almost all these nesting associations. As to the protection derived by the weakest birds from their unions, it is evident. That excellent observer, Dr. Couës, saw, for instance, the little cliff-swallows nesting in the immediate neighbourhood of the prairie falcon (*Falco polyargus*). The falcon had its nest on the top of one of the minarets of clay which are so common in the cañons of Colorado, while a colony of swallows nested just beneath. The little peaceful birds had no fear of their rapacious neighbour; they even did not let it approach to their colony. They immediately surrounded it and chased it, so that it had to make off at once.[4]

Life in societies does not cease when the nesting period is over; it begins then in a new form. The young broods gather in societies of youngsters, generally including several species. Social life is practised at that time chiefly for its own sake—partly for security, and chiefly for the pleasures derived from it. So we see in our forests the societies formed by the young nuthatchers (*Sitta cæsia*), together with titmouses, chaffinches, wrens, tree-creepers, or some wood-peckers.[5] In Spain the swallow is met with in company with kestrels, fly-catchers, and even pigeons. In the Far West the young horned larks live in large societies, together with another lark (Sprague's), the sky-lark, the Savannah sparrow, and several species of buntings and longspurs.[6] In fact, it would be much easier to describe the species which live isolated than to simply name those species which join the autumnal societies of young birds—not for hunting or nesting purposes, but simply to enjoy life in society and to spend their time in plays and sports, after having given a few hours every day to find their daily food.

And, finally, we have that immense display of mutual aid among birds—their migrations—which I dare not even enter upon in a review article. Sufficient to say that birds which have lived for months in small bands scattered over a wide territory gather in thousands; they come together at a given place, for several days in succession, before they start, and they evidently discuss the particulars of the journey. Some species will indulge every afternoon in flights preparatory to the long passage. All wait for their tardy congeners, and finally they start in a certain well-chosen direction—a fruit of accumulated collective experience—the strongest flying at the head of the band, and relieving one another in that difficult task. They

[4] Elliot Couës, in *Bulletin U.S. Geol. Survey of Territories*, iv. No. 7, pp. 556, 579, &c.

[5] Brehm Father, quoted by A. Brehm, iv. 34 sq. See also White's *Natural History of Selborne*, Letter XI.

[6] Dr. Couës' *Birds of Dakota and Montana*, in *Bulletin U.S. Survey of Territories*, iv. No. 7.

cross the seas in large bands consisting of both big and small birds, and when they return next spring they repair to the same spot, and, in most cases, each of them takes possession of the very same nest which it had built or repaired the previous year.[7]

Going now over to mammals, the first thing which strikes us is the overwhelming numerical predominance of social species over those few carnivores which do not associate. The plateaus, the Alpine tracts, and the steppes of the Old and New World are stocked with herds of deer, antelopes, gazelles, fallow deer, buffaloes, wild goats and sheep, all of which are sociable animals. When the Europeans came to settle in America, they found it so densely peopled with buffaloes, that pioneers had to stop their advance when a column of migrating buffaloes came to cross the route they followed; the march past of the dense column lasting sometimes for two and three days. And when the Russians took possession of Siberia they found it so densely peopled with deer, antelopes, squirrels, and other sociable animals, that the very conquest of Siberia was nothing but a hunting expedition which lasted for two hundred years. Not long ago the small streams of Northern America and Northern Siberia were peopled with colonies of beavers, and up to the seventeenth century like colonies swarmed in Northern Russia. The flat lands of the four great continents are still covered with countless colonies of mice, ground squirrels, marmots, and other rodents.

In the lower latitudes of Asia and Africa the forests are still the abode of numerous families of elephants, rhinoceroses, and numberless societies of monkeys. In the far north the reindeer aggregate in numberless herds; while still further north we find the herds of the musk-oxen and numberless bands of polar foxes. The coasts of the ocean are enlivened by flocks of seals and morses; its waters, by shoals of sociable cetaceans; and even in the depths of the great plateau of Central Asia we find herds of wild horses, wild donkeys, wild camels, and wild sheep. All these mammals live in societies and nations sometimes numbering hundreds of thousands of individuals, although now, after three centuries of gunpowder civilisation, we find but the *débris* of the immense aggregations of old. How trifling, in comparison with them, are the numbers of the carnivores! And how false, therefore, is the view of those who speak of the animal world as if nothing were to be seen in it but lions and hyenas plunging their bleeding teeth into the flesh of their victims! One

[7] It has often been intimated that larger birds may occasionally *transport* some of the smaller birds when they cross together the Mediterranean, but the fact still remains doubtful. On the other side, it is certain that some smaller birds join the bigger ones for migration. The fact has been noticed several times, and it was recently confirmed by L. Buxbaum at Raunheim. He saw several parties of cranes which had larks flying in the midst and on both sides of their migratory columns.—*Der zoologische Garten*, 1886, p. 133.

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[8] Tschudi, *Thierleben der Alpenwelt*, p. 404.

[9] Houzeau's *Études*, ii. 463.

[10] For their hunting associations see Sir E. Tennan
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[11] See Emil Hüter's letter in L. Büchner's *Liebe*.

might as well imagine that the whole of human life is nothing but a succession of Tel-el-Kebir and Geok-tepé massacres.

Association and mutual aid are the rule with mammals. We find social habits even among the carnivores, and we can only name the cat tribe (lions, tigers, leopards, &c.) as a division the members of which decidedly prefer isolation to society, and are but seldom met with even in small groups. The two tribes of the civets (*Viverridæ*) and the weasels (*Mustelidæ*) might also be characterised by their isolated life, but it is a fact that during the last century the common weasel was more sociable than it is now; it was seen then in larger groups in Scotland and in the Unterwalden canton of Switzerland. As to the great tribe of the dogs, it is eminently sociable, and association for hunting purposes may be considered as characteristic of its numerous species. It is well known, in fact, that wolves gather in packs for hunting, and Tschudi left an excellent description of how they draw up in a half-circle, surround a cow which is grazing on a mountain slope, and then, suddenly appearing with a loud barking, make it roll in the abyss.[8] During severe winters their packs grow so numerous as to become a danger for human settlements, as was the case in France some five-and-forty years ago. In the Russian steppes they never attack the horses otherwise than in packs; and yet they have to sustain bitter fights, during which the horses (according to Kohl's testimony) sometimes assume offensive warfare, and in such cases, if the wolves do not retreat promptly, they run the risk of being surrounded by the horses and killed by their hoofs. The prairie-wolves (*Canis latrans*) are known to associate in bands of from twenty to thirty individuals when they chase a buffalo occasionally separated from its herd.[9] Jackals, which are most courageous and may be considered as one of the most intelligent representatives of the dog tribe, always hunt in packs; thus united, they have no fear of the bigger carnivores.[10] As to the wild dogs of Asia (the (*Kholzuns*, or *Dholes*), Williamson saw their large packs attacking all larger animals save elephants and rhinoceroses, and overpowering bears and tigers. Hyænas always live in societies and hunt in packs, and the hunting organisations of the painted lycaons are highly praised by Cumming. Nay, even foxes, which, as a rule, live isolated in our civilised countries, have been seen combining for hunting purposes.[11] As to the polar fox, it is—or rather was in Steller's time—one of the most sociable animals; and when one reads Steller's description of the war that was waged by Behring's unfortunate crew against these intelligent small animals, one does not know what to wonder at most:

[8] Tschudi, *Thierleben der Alpenwelt*, p. 404.

[9] Houzeau's *Études*, ii. 463.

[10] For their hunting associations see Sir E. Tennant's *Natural History of Ceylon*, quoted in Romanes's *Animal Intelligence*, p. 432.

[11] See Emil Hüter's letter in L. Büchner's *Liebe*.

the extraordinary intelligence of the foxes and the mutual aid they displayed in digging out food concealed under cairns, or stored upon a pillar (one fox would climb on its top and throw the food to its comrades beneath), or the cruelty of man, driven to despair by the numerous packs of foxes. Even some bears live in societies where they are not disturbed by man. Thus Steller saw the black bear of Kamtchatka in numerous packs, and the polar bears are occasionally found in small groups. Even the unintelligent insectivores do not always disdain association.

However, it is especially with the rodents, the ungulata, and the ruminants that we find a highly developed practice of mutual aid. The squirrels are individualist to a great extent. Each of them builds its own comfortable nest, and accumulates its own provision. Their inclinations are towards family life, and Brehm found that a family of squirrels is never so happy as when the two broods of the same year can join together with their parents in a remote corner of a forest. And yet they maintain social relations. The inhabitants of the separate nests remain in a close intercourse, and when the pine-cones become rare in the forest they inhabit, they emigrate in bands. As to the black squirrels of the Far West, they are eminently sociable. Apart from the few hours given every day to foraging, they spend their lives in playing in numerous parties. And when they multiply too rapidly in a region, they assemble in bands, almost as numerous as those of locusts, and move southwards, devastating the forests, the fields, and the gardens; while foxes, polecats, falcons, and nocturnal birds of prey follow their thick columns and live upon the individuals remaining behind. The ground squirrel—a closely akin genus—is still more sociable. It is given to hoarding, and stores up in its subterranean halls large amounts of edible roots and nuts, usually plundered by man in the autumn. According to some observers, it must know something of the joys of a miser. And yet it remains sociable. It always lives in large villages, and Audubon, who opened some dwellings of the hackee in the winter, found several individuals in the same apartment; they must have stored it with common efforts.

The large tribe of the marmots, which includes the three large genuses of *Arctomys*, *Cynomys*, and *Spermophilus*, is still more sociable and still more intelligent. They also prefer having each one its own dwelling; but they live in big villages. That terrible enemy of the crops of South Russia—the *souslik*—of which some ten millions are exterminated every year by man alone, lives in numberless colonies; and while the Russian provincial assemblies gravely discuss the means of getting rid of this enemy of society, it enjoys life in its thousands in the most joyful way. Their play is so charming that no observer could refrain from paying them a tribute of praise, and from mentioning the melodious concerts arising from the

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sharp whistlings of the males and the melancholic whistlings of the females, before—suddenly returning to his citizen's duties—he begins inventing the most diabolic means for the extermination of the little robbers. All kinds of rapacious birds and beasts of prey having proved powerless, the last word of science in this warfare is the inoculation of cholera! The villages of the prairie-dogs in America are one of the loveliest sights. As far as the eye can embrace the prairie, it sees heaps of earth, and on each of them a prairie-dog stands, engaged in a lively conversation with its neighbours by means of short barkings. As soon as the approach of man is signalled, all plunge in a moment into their dwellings; all has disappeared as by enchantment. But if the danger is over, the little creatures soon reappear. Whole families come out of their galleries and indulge in play. The young ones scratch one another, they worry one another, and display their gracefulness while standing upright, and in the meantime the old ones keep watch. They go visiting one another, and the beaten footpaths which connect all their heaps testify of the frequency of the visitations. In short, the best naturalists have written some of their best pages in describing the associations of the prairie-dogs of America, the marmots of the Old World, and the polar marmots of the Alpine regions. And yet, I must make, as regards the marmots, the same remark as I have made when speaking of the bees. They have maintained their fighting instincts, and these instincts reappear in captivity. But in their big associations, in the face of free Nature, the unsociable instincts have no opportunity to develop, and the general result is peace and harmony.

Even such harsh animals as the rats which continually fight in our cellars are sufficiently intelligent not to quarrel when they plunder our larders, but to aid one another in their plundering expeditions and migrations, and even to feed their invalids. As to the beaver-rats or musk-rats of Canada, they are extremely sociable. Audubon could not but admire 'their peaceful communities, which require only being left in peace to enjoy happiness.' Like all sociable animals, they are lively and playful, they easily combine with other species, and they have attained a very high degree of intellectual development. In their villages, always disposed on the shores of lakes and rivers, they take into account the changing level of water; their dome-shaped houses, which are built of beaten clay interwoven with reeds, have separate corners for organic refuse, and their halls are well carpeted at winter-time; they are warm, and, nevertheless, well ventilated. As to the beavers, which are endowed, as known, with a most sympathetic character, their astounding dams and villages, in which generations live and die without knowing of any enemies but the otter and man, so wonderfully illustrate what mutual aid can achieve for the security of the species, the development of social habits, and the evolution of intelligence, that they

are familiar to all interested in animal life. Let me only remark that with the beavers, the musk-rats, and some other rodents, we already find the feature which will also be distinctive of human communities—that is, work in common.

I pass in silence the two large families which include the jerboa, the chinchilla, the *biscacha*, and the *tushkan*, or underground hare of South Russia, though all these small rodents might be taken as excellent illustrations of the pleasures derived by animals from social life. Precisely, the pleasures; because it is extremely difficult to say what brings animals together—the needs of mutual protection, or simply the pleasure of feeling surrounded by their congeners. At any rate, our common hares, which do not gather in societies for life in common, and which are not even endowed with intense parental feelings, cannot live without coming together for play. Dietrich de Winckell, who is considered to be among the best acquainted with the habits of hares, describes them as passionate players, becoming so intoxicated by their play that a hare has been known to take an approaching fox for a playmate.[12] As to the rabbit, it lives in societies, and its family life is entirely built upon the image of the old patriarchal family; the young ones being kept in absolute obedience to the father and even the grandfather.[13] And here we have the example of two very closely allied species which cannot bear each other—not because they live upon nearly the same food, as like cases are too often explained, but most probably because the passionate, eminently individualist hare cannot make friends with that placid, quiet, and submissive creature, the rabbit. Their tempers are too widely different not to be an obstacle to friendship.

Life in societies is again the rule with the large family of horses, which includes the wild horses and donkeys of Asia, the zebras, the mustangs, the *cimarrones* of the Pampas, and the half-wild horses of Mongolia and Siberia. They all live in numerous associations made up of many studs, each of which consists of a number of mares under the leadership of a male. These numberless inhabitants of the Old and the New World, badly organised on the whole for resisting both their numerous enemies and the adverse conditions of climate, would soon have disappeared from the surface of the earth were it not for their sociable spirit. When a beast of prey approaches them, several studs unite at once; they repulse the beast and sometimes chase it: and neither the wolf nor the bear, not even the lion, can capture a horse or even a zebra as long as they are not detached from the herd. When a drought is burning the grass in the prairies, they gather in herds of sometimes 10,000 individuals strong, and migrate. And when a snow-storm rages in the steppes, each stud keeps close

[12] *Handbuch für Jäger und Jagdberechtigte*, quoted by Brehm, ii. 223.

[13] Buffon's *Histoire Naturelle*.

together, and repairs to a protected ravine appears, or the group has been seized by horses perish and the survivors are found from fatigue. Union is their chief arm in man is their chief enemy. Before his ancestors of our domestic horse (the *Equ* by Polyakoff) have preferred to retire to th sible plateaus on the outskirts of Thibet, wh surrounded by carnivores, under a climate a regions, but in a region inaccessible to man

Many striking illustrations of social life life of the reindeer, and especially of that la which might include the roebucks, the f the gazelles, the ibex, and, in fact, the who families of the Antelopides, the Caprides, watchfulness over the safety of their herds vores; the anxiety displayed by all individu as long as all of them have not cleared a dif cliffs; the adoption of orphans; the despa mate, or even comrade of the same sex, ha of the youngsters, and many other feature But perhaps the most striking illustration o by the occasional migrations of fallow deer, s Amur. When I crossed the high plateau Great Khingan, on my way from Transba further travelled over the high prairies on could ascertain how thinly peopled with f uninhabited regions are.[15] Two years later Amur, and by the end of October reached picturesque gorge which the Amur pierces in Khingan) before it enters the lowlands whe I found the Cossacks in the villages of that g citement, because thousands and thousands of the Amur where it is narrowest, in order to r several days in succession, upon a length of river, the Cossacks were butchering the de

[14] In connection with the horses it is worthy of n which never comes together with the dauw zebra, neverth not only with ostriches, which are very good sentries, b species of antelopes, and gnus. We thus have a case o quagga and the dauw which cannot be explained by co that the quagga lives together with ruminants feeding excludes that hypothesis, and we must look for some as in the case of the hare and the rabbit.

[15] Our Tungus hunter, who was going to marry, and the desire of getting as many furs as he possibly could, day long on horseback in search of deer. His efforts w much as one fallow deer killed every day; and he was a

together, and repairs to a protected ravine. But if confidence disappears, or the group has been seized by panic, and disperses, the horses perish and the survivors are found after the storm half dying from fatigue. Union is their chief arm in the struggle for life, and man is their chief enemy. Before his increasing numbers the ancestors of our domestic horse (the *Equus Przewalskii*, so named by Polyakoff) have preferred to retire to the wildest and least accessible plateaus on the outskirts of Thibet, where they continue to live, surrounded by carnivores, under a climate as bad as that of the Arctic regions, but in a region inaccessible to man.[14]

Many striking illustrations of social life could be taken from the life of the reindeer, and especially of that large division of ruminants which might include the roebucks, the fallow deer, the antelopes, the gazelles, the ibex, and, in fact, the whole of the three numerous families of the Antelopides, the Caprides, and the Ovides. Their watchfulness over the safety of their herds against attacks of carnivores; the anxiety displayed by all individuals in a herd of chamois as long as all of them have not cleared a difficult passage over rocky cliffs; the adoption of orphans; the despair of the gazelle whose mate, or even comrade of the same sex, has been killed; the plays of the youngsters, and many other features, could be mentioned. But perhaps the most striking illustration of mutual support is given by the occasional migrations of fallow deer, such as I saw once on the Amur. When I crossed the high plateau and its border ridge, the Great Khingan, on my way from Transbaikalia to Merghen, and further travelled over the high prairies on my way to the Amur, I could ascertain how thinly peopled with fallow deer these mostly uninhabited regions are.[15] Two years later I was travelling up the Amur, and by the end of October reached the lower end of that picturesque gorge which the Amur pierces in the Dousse-alin (Little Khingan) before it enters the lowlands where it joins the Sungari. I found the Cossacks in the villages of that gorge in the greatest excitement, because thousands and thousands of fallow deer were crossing the Amur where it is narrowest, in order to reach the lowlands. For several days in succession, upon a length of some forty miles up the river, the Cossacks were butchering the deer as they crossed the

[14] In connection with the horses it is worthy of notice that the quagga zebra, which never comes together with the dauw zebra, nevertheless lives on excellent terms, not only with ostriches, which are very good sentries, but also with gazelles, several species of antelopes, and gnus. We thus have a case of mutual dislike between the quagga and the dauw which cannot be explained by competition for food. The fact that the quagga lives together with ruminants feeding on the same grass as itself excludes that hypothesis, and we must look for some incompatibility of character, as in the case of the hare and the rabbit.

[15] Our Tungus hunter, who was going to marry, and therefore was prompted by the desire of getting as many furs as he possibly could, was beating the hill-sides all day long on horseback in search of deer. His efforts were not rewarded by even so much as one fallow deer killed every day; and he was an excellent hunter.

Amur, in which already floated a good deal of ice. Thousands were killed every day, and the exodus nevertheless continued. Like migrations were never seen either before or since, and this one must have been called for by an early and heavy snow-fall in the Great Khingan, which compelled the deer to make a desperate attempt at reaching the lowlands in the east of the Dousse mountains. Indeed, a few days later the Dousse-alin was also buried under snow two or three feet deep. Now, when one imagines the immense territory (almost as big as Great Britain) from which the scattered groups of deer must have gathered for a migration which was undertaken under the pressure of exceptional circumstances, and realises the difficulties which had to be overcome before all the deer came to the common idea of crossing the Amur further south, where it is narrowest, one cannot but deeply admire the amount of sociability displayed by these intelligent animals. The fact is not the less striking if we remember that the bisons of North America display the same powers of combination. One sees them grazing in great numbers in the plains, but these numbers are made up by an infinity of small groups which never mix together. And yet, when necessity arises, all groups, however scattered over an immense territory, come together and make up those immense columns, numbering hundreds of thousands of individuals, which I mentioned on a preceding page.

I also ought to say a few words at least about the 'compound families' of the elephants, their mutual attachment, their deliberate ways in posting sentries, and the feelings of sympathy developed by such a life of close mutual support. I might mention the sociable feelings of those disreputable creatures the wild boars, and find a word of praise for their powers of association in the case of an attack by a beast of prey. The hippopotamus and the rhinoceros, too, would occupy a place in a work devoted to animal sociability. Several striking pages might be given to the sociability and mutual attachment of the seals and the walruses; and finally, one might mention the most excellent feelings existing among the sociable cetaceans. But I have to say yet a few words about the societies of monkeys, which acquire an additional interest from their being the link which will bring us to the societies of primitive men.

It is hardly needful to say that those mammals, which stand at the very top of the animal world and most approach man by their structure and intelligence, are eminently sociable. Evidently we must be prepared to meet with all varieties of character and habits in so great a division of the animal kingdom which includes hundreds of species. But, all things considered, it must be said that sociability, action in common, mutual protection, and a high development of those feelings which are the necessary outcome of social life, are characteristic of most monkeys and apes. From the smallest species to the biggest ones, sociability is a rule to which we know but a few exceptions.

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[16] Romanes's *Animal Intelligence*, p. 472.
[17] Brehm, i. 82; Darwin's *Descent of Man*,

The nocturnal apes prefer isolated life; the capuchins (*Cebus capucinus*), the monos, and the howling monkeys live but in small families; and the orang-outangs have never been seen by Mr. Wallace otherwise than either solitary or in very small groups of three or four individuals, while the gorillas seem never to join in bands. But all the remainder of the monkey tribe—the chimpanzees, the sajous, the sakis, the mandrills, the baboons, and so on—are sociable in the highest degree. They live in great bands, and even join with other species than their own. Most of them become quite unhappy when solitary. The cries of distress of each one of the band immediately bring together the whole of the band, and they boldly repulse the attacks of most carnivores and birds of prey. Even eagles do not dare attack them. They plunder our fields always in bands—the old ones taking care for the safety of the commonwealth. The little tee-tees, whose childish sweet faces so much struck Humboldt, embrace and protect one another when it rains, rolling their tails over the necks of their shivering comrades. Several species display the greatest solicitude for their wounded, and do not abandon a wounded comrade during a retreat till they have ascertained that it is dead and that they are helpless to restore it to life. Thus James Forbes narrated in his *Oriental Memoirs* a fact of such resistance in reclaiming from his hunting party the dead body of a female monkey that one fully understands why 'the witnesses of this extraordinary scene resolved never again to fire at one of the monkey race.'[16] In some species several individuals will combine to overturn a stone in order to search for ants' eggs under it. The hamadryas not only post sentries, but have been seen making a chain for the transmission of the spoil to a safe place; and their courage is well known. Brehm's description of the regular fight which his caravan had to sustain before the hamadryas would let it resume its journey in the valley of the Mensa, in Abyssinia, has become classical.[17] The playfulness of the tailed apes and the mutual attachment which reigns in the families of chimpanzees also are familiar to the general reader. And if we find among the highest apes two species, the orang-outang and the gorilla, which are not sociable, we must remember that both—limited as they are to very small areas, the one in the heart of Africa, and the other in the two islands of Borneo and Sumatra—have all the appearance of being the last remnants of formerly much more numerous species. The gorilla at least seems to have been sociable in olden times, if the apes mentioned in the *Periplus* really were gorillas.

We thus see, even from the above very brief review, that life in societies is no exception in the animal world; it is the rule, the law of Nature, and it reaches its fullest development with the higher

[16] Romanes's *Animal Intelligence*, p. 472.
[17] Brehm, i. 82; Darwin's *Descent of Man*, ch. iii.

vertebrates. Those species which live solitary, or in small families only, are relatively few, and their numbers are limited. Nay, it appears very probable that, apart a few exceptions, those birds and mammals which are not gregarious now, were living in societies before man multiplied on the earth and waged a permanent war against them, or destroyed the sources from which they formerly derived food. 'On ne s'associe pas pour mourir,' was the sound remark of Espinas; and Houzeau, who knew the animal world of some parts of America when it was not yet affected by man, wrote to the same effect.

Association is found in the animal world at all degrees of evolution; and, according to the grand idea of Herbert Spencer, so brilliantly developed in Perrier's *Colonies Animales*, colonies are at the very origin of evolution in the animal kingdom. But, in proportion as we ascend the scale of evolution, we see association growing more and more conscious. It loses its purely physical character, it ceases to be simply instinctive, it becomes reasoned. With the higher vertebrates it is periodical, or is resorted to for the satisfaction of a given want—propagation of the species, migration, hunting, or mutual defence. It even becomes occasional, when birds associate against a robber, or mammals combine, under the pressure of exceptional circumstances, to emigrate. In this last case, it becomes a voluntary deviation from habitual moods of life. The combination sometimes appears in two or more degrees—the family first, then the group, and finally the association of groups, habitually scattered, but uniting in case of need, as we saw it with the bisons and other ruminants. It also takes higher forms, guaranteeing more independence to the individual without depriving it of the benefits of social life. With most rodents the individual has its own dwelling, which it can retire to when it prefers being left alone; but the dwellings are laid out in villages and cities, so as to guarantee to all inhabitants the benefits and joys of social life. And finally, in several species, such as rats, marmots, hares, &c., sociable life is maintained notwithstanding the quarrelsome or otherwise egotistic inclinations of the isolated individual. Thus it is not imposed, as is the case with ants and bees, by the very physiological structure of the individuals; it is cultivated for the benefits of mutual aid, or for the sake of its pleasures. And this, of course, appears with all possible gradations and with the greatest variety of individual and specific characters—the very variety of aspects taken by social life being a consequence, and for us a further proof, of its generality. [18]

[18] The more strange it is to read in the previously mentioned article by Mr. Huxley the following paraphase of a well-known sentence of Rousseau: 'The first men who substituted mutual peace for that of mutual war—whatever the motive which impelled them to take that step—*created society*' (*Nineteenth Century*, Feb. 1888, p. 165). Society has *not* been created by man; it is anterior to man.

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That life in societies is the most powerful weapon in the struggle for life, taken in its widest sense, has been illustrated by several examples on the foregoing pages, and could be illustrated by any amount of evidence, if further evidence were required. Life in societies enables the feeblest insects, the feeblest birds, and the feeblest mammals to resist, or to protect themselves from, the most terrible birds and beasts of prey; it permits longevity; it enables the species to rear its progeny with the least waste of energy and to maintain its numbers albeit a very slow birth-rate; it enables the gregarious animals to migrate in search of new abodes. Therefore, while fully admitting that force, swiftness, protective colours, cunningness, and endurance to hunger and cold, which are mentioned by Darwin and Wallace, are so many qualities making the individual, or the species, the fittest under certain circumstances, we maintain that under *any* circumstances sociability is the greatest advantage in the struggle for life. Those species which willingly or unwillingly abandon it are doomed to decay; while those animals which know best how to combine, have the greatest chances of survival and of further evolution, although they may be inferior to others in *each* of the faculties enumerated by Darwin and Wallace, save the intellectual faculty. The highest vertebrates, and especially mankind, are the best proof of this assertion. As to the intellectual faculty, while every Darwinist will agree with Darwin that it is the most powerful arm in the struggle for life, and the most powerful factor of further evolution, he also will admit that intelligence is an eminently social faculty. Language, imitation, and accumulated experience are so many elements of growing intelligence of which the unsociable animal is deprived. Therefore we find, at the top of each class of animals, the ants, the parrots, and the monkeys, all combining the greatest sociability with the highest development of intelligence. The fittest are thus 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 favouring the growth of intelligence.

Moreover, it is evident that life in societies would be utterly impossible without a corresponding development of social feelings, and, especially, of a certain collective sense of justice growing to become a habit. If every individual were constantly abusing its personal advantages without the others interfering in favour of the wronged, no society-life would be possible. And feelings of justice develop, more or less, with all gregarious animals. Whatever the distance from which the swallows or the cranes come, each one returns to the nest it has built or repaired last year. If a lazy sparrow intends appropriating the nest which a comrade is building, or even steals from it a few sprays of straw, the group interferes against the lazy comrade; and it is evident that without such inter-

ference being the rule, no nesting associations of birds could exist. Separate groups of penguins have separate resting places and separate fishing abodes, and do not fight for them. The droves of cattle in Australia have particular spots to which each group repairs to rest, and from which it never deviates; and so on.[19] We have any numbers of direct observations of the peace that prevails in the nesting associations of birds, the villages of the rodents, and the herds of grass-eaters; while, on the other side, we know of few sociable animals which so continually quarrel as the rats in our cellars do, or as the morses, which fight for the possession of a sunny place on the shore. Sociability thus puts a limit to physical struggle, and leaves room for the development of better moral feelings. The high development of parental love in all classes of animals, even with lions and tigers, is generally known. As to the young birds and mammals whom we continually see associating, sympathy—not love—attains a further development in their associations. Leaving aside the really touching facts of mutual attachment and compassion which have been recorded as regards domesticated animals and with animals kept in captivity, we have a number of well-certified facts of compassion between wild animals at liberty. Max Perty and L. Büchner have given a number of such facts.[20] J. C. Wood's narrative of a weasel which came to pick up and to carry away an injured comrade enjoys a well-merited popularity.[21] So also the observation of Captain Stansbury on his journey to Utah which is quoted by Darwin; he saw a blind pelican which was fed, and well fed, by other pelicans upon fishes which had to be brought from a distance of thirty miles.[22] As to facts of compassion with wounded comrades, they are continually mentioned by all field zoologists. Such facts are quite natural. Compassion is a necessary outcome of social life. But compassion also means a considerable advance in general intelligence and sensibility. It is the first step towards the development of higher moral sentiments. It is, in its turn, a powerful factor of further evolution.

If the views developed on the preceding pages are correct, the question necessarily arises, in how far are they consistent with the theory of struggle for life as it has been developed by Darwin, Wallace, and their followers? and I will now briefly answer this important question. First of all, no naturalist will doubt that the idea of a

[19] Haygarth, *Bush Life in Australia*, p. 58.

[20] To quote but a few instances, a wounded badger was carried away by another badger suddenly appearing on the scene; rats have been seen feeding a blind couple (*Seelenleben der Thiere*, p. 64 *sq.*) Brehm himself saw two crows feeding in a hollow tree a third crow which was wounded; its wound was several weeks old (*Hausfreund*, 1874, 715; Büchner's *Liebe*, 203). Mr. Blyth saw Indian crows feeding two or three blind comrades; and so on.

[21] *Man and Beast*, p. 344.

[22] L. H. Morgan, *The American Beaver*, 1868, p. 272; *Descent of Man* ch. iv.

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struggle for life carried on through organic nature is the greatest generalisation of our century. Life *is* struggle; and in that struggle the fittest survive. But the answers to the questions, 'By which arms is this struggle chiefly carried on?' and 'Who are the fittest in the struggle?' will widely differ according to the importance given to the two different aspects of the struggle: the direct one, for food and safety among separate individuals, and the struggle which Darwin described as 'metaphorical'—the struggle, very often collective, against adverse circumstances. No one will deny that there is, within each species, a certain amount of real competition for food—at least, at certain periods. But the question is, whether competition is carried on to the extent admitted by Darwin, or even by Wallace; and whether this competition has played, in the evolution of the animal kingdom, the part assigned to it.

The idea which permeates Darwin's work is certainly one of real competition going on within each animal group for food, safety, and possibility of leaving an offspring. He often speaks of regions being stocked with animal life to their full capacity, and from that overstocking he infers the necessity of competition. But when we look in his work for real proofs of that competition, we must confess that we do not find them sufficiently convincing. If we refer to the paragraph entitled 'Struggle for Life most severe between Individuals and Varieties of the same Species,' we find in it none of that wealth of proofs and illustrations which we are accustomed to find in whatever Darwin wrote. The struggle between individuals of the same species is not illustrated under that heading by even one single instance: it is taken as granted; and the competition between closely allied animal species is illustrated by but five examples, out of which one, at least (relating to the two species of thrushes), now proves to be doubtful.[23] But when we look for more details in order to ascertain how far the decrease of one species was really occasioned by the increase of the other species, Darwin, with his usual fairness, tells us:

[23] One species of swallow is said to have caused the decrease of another swallow species in North America; the recent increase of the missel-thrush in Scotland has caused the decrease of the song-thrush; the brown rat has taken the place of the black rat in Europe; in Russia the small cockroach has everywhere driven before it its greater congener; and in Australia the imported hive-bee is rapidly exterminating the small stingless bee. Two other cases, but relative to domesticated animals, are mentioned in the preceding paragraph. While recalling these same facts, Mr. Wallace remarks in a foot-note relative to the Scottish thrushes: 'Prof. A. Newton, however, informs me that these species do not interfere in the way here stated' (*Darwinism*, p. 34). As to the brown rat, it is known that, owing to its amphibian habits, it usually stays in the lower parts of human dwellings (low cellars, sewers, &c.), as also on the banks of canals and rivers; it also undertakes distant migrations in numberless bands. The black rat, on the contrary, prefers staying in our dwellings themselves, under the floor, as well as in our stables and barns. It thus is much more exposed to be exterminated by man; and we cannot maintain, with any approach to certainty, that the black rat is being either exterminated or starved out by the brown rat and not by man.

We can dimly see why the competition should be most severe between allied forms which fill nearly the same place in nature; but probably in no case could we precisely say why one species has been victorious over another in the great battle of life.

As to Wallace, who quotes the same facts under a slightly modified heading ('Struggle for Life between closely-allied Animals and Plants *often* most severe'), he makes the following remark (italics are mine), which gives quite another aspect to the facts above quoted. He says:

In *some* cases, no doubt, there is actual war between the two, the stronger killing the weaker; *but this is by no means necessary*, and there may be cases in which the weaker species, physically, may prevail by its power of more rapid multiplication, its better withstanding vicissitudes of climate, or its greater cunning in escaping the attacks of common enemies.

In such cases what is described as competition may be no competition at all. One species succumbs, not because it is exterminated or starved out by the other species, but because it does not well accommodate itself to new conditions, which the other does. The term 'struggle for life' is again used in its metaphorical sense, and may have no other. As to the real competition between individuals of the same species, which is illustrated in another place by the cattle of South America during a period of drought, its value is impaired by its being taken from among domesticated animals. Bisons emigrate in like circumstances in order to avoid competition. However severe the struggle between plants—and this is amply proved—we cannot but repeat Wallace's remark to the effect that 'plants live where they can,' while animals have, to a great extent, the power of choice of their abode. So that we again are asking ourselves, To what extent does competition really exist within each animal species? Upon what is the assumption based?

The chief argument as known is—to use Professor Geddes' expression—the 'arithmetical argument' borrowed from Malthus.[24] But this argument does not prove it at all. We might as well take a number of villages in South-East Russia, the inhabitants of which enjoy plenty of food, but have no sanitary accommodation of any kind; and seeing that for the last eighty years the birth-rate was sixty in the thousand, while the population is now what it was eighty years ago, we might conclude that there has been a terrible competition between the inhabitants. But the truth is that from year to year the population remained stationary, for the simple reason that one-third of the newborn died before reaching their sixth month of

[24] I must omit here the discussion of the indirect argument, which might be derived from the supposed extermination of the varieties intermediate between two species. That discussion would bring us too far, the more so as that argument touches upon one of the most contested parts of the Darwinian theory—namely, in how far isolation is necessary for the appearance of new species.

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life; one-half died within the next four years, and out of each hundred born, only seventeen or so reached the age of twenty. The newcomers went away before having grown to be competitors. It is evident that if such is the case with men, it is still more the case with animals. In the feathered world the destruction of the eggs goes on on such a tremendous scale that eggs are the chief food of several species in the early summer; not to say a word of the storms, the inundations which destroy nests by the million in America, and the sudden changes of weather which are fatal to the young mammals. Each storm, each inundation, each visit of a rat to a bird's nest, each sudden change of temperature, take away those competitors which appear so terrible in theory.

As to the facts of an extremely rapid increase of horses and cattle in America, of pigs and rabbits in New Zealand, and even of wild animals imported from Europe (where their numbers are kept down by man, not by competition), they rather seem opposed to the theory of over-population. If horses and cattle could so rapidly multiply in America, it simply shows that, however numberless the bisons and other ruminants were at that time in the New World, its grass-eating population was far below what the prairies could maintain. If millions of intruders have found plenty of food without starving out the former population of the prairies, we must rather conclude that the Europeans found a *want* of grass-eaters in America, not an excess. And we have good reasons to believe that want of animal population is the natural state of things all over the world, with but a few temporary exceptions to the rule. The actual numbers of animals in a given region are determined, not by the highest feeding capacity of the region, but by what it is every year under the most unfavourable conditions. So that, for that reason alone, competition hardly can be a normal condition; but other causes intervene as well to cut down the animal population below even that low standard. It we take the horses and cattle which are grazing all the winter through in the steppes of Transbaikalia, we find them very lean and exhausted at the end of the winter. But they grow exhausted not because there is not enough food for all of them—the grass buried under a thin sheet of snow is everywhere in abundance—but because of the difficulty of getting it from beneath the snow, and this difficulty is the same for all horses alike. Besides, days of glazed frost are common in early spring, and if several such days come in succession the horses grow still more exhausted. But then comes a snowstorm, which compels the already weakened animals to remain without any food for several days, and very great numbers of them die. The losses during the spring are so severe that if the season has been more inclement than usual they are even not repaired by the new breeds—the more so as *all* horses are exhausted,

and the young foals are born in a weaker condition. The numbers of horses and cattle thus always remain beneath what they otherwise might be; all the year round there is food for five or ten times as many animals, and yet their population increases extremely slowly. But as soon as the Buriate owner makes ever so small a provision of hay in the steppe, and throws it open during days of glazed frost, or heavier snowfall, he immediately sees the increase of his herd. Almost all free grass-eating animals and many rodents in Asia and America being in very much the same conditions, we can safely say that their numbers are *not* kept down by competition; that at no time of the year they can struggle for food, and that if they never reach anything approaching to over-population, the cause is in the climate, not in competition.

The importance of natural checks to over-multiplication, and especially their bearing upon the competition hypothesis, seems never to have been taken into due account. The checks, or rather some of them, are mentioned, but their action is seldom studied in detail. However, if we compare the action of the natural checks with that of competition, we must recognise at once that the latter sustains no comparison whatever with the other checks. Thus, Mr. Bates mentions the really astounding numbers of winged ants which are destroyed during their exodus. The dead or half-dead bodies of the formica de fuego (*Myrmica sævissima*) which had been blown into the river during a gale 'were heaped in a line an inch or two in height and breadth, the line continuing without interruption for miles at the edge of the water.'[25] Myriads of ants are thus destroyed amidst a nature which might support a hundred times as many ants as are actually living. Dr. Altum, a German forester, who wrote a very interesting book about animals injurious to our forests, also gives many facts showing the immense importance of natural checks. He says that a succession of gales or cold and damp weather during the exodus of the pine-moth (*Bombyx pini*) destroy it to incredible amounts, and during the spring of 1871 all these moths disappeared at once, probably killed by a succession of cold nights.[26] Many like examples relative to various insects could be quoted from various parts of Europe. Dr. Altum also mentions the bird-enemies of the pine-moth, and the immense amounts of its eggs destroyed by foxes; but he adds that the parasitic fungi which periodically infest it are a far more terrible enemy than any bird, because they destroy the moth over very large areas at once. As to various species of mice (*Mus sylvaticus*, *Arvicola arvalis*, and *A. agrestis*), the same author gives a long list of their enemies, but he remarks: 'However, the

[25] *The Naturalist on the River Amazons*, ii. 85, 95, 69.

[26] Dr. B. Altum, *Waldbeschädigungen durch Thiere und Gegenmittel* (Berlin, 1889), pp. 207 *seq.*

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[27] Dr. B. Altum, *ut supra*, pp. 13 and 187.

[28] A Becker in the *Bulletin de la Société des Naturalistes de*

most terrible enemies of mice are not other animals, but such sudden changes of weather as occur almost every year.' Alternations of frost and warm weather destroy them in numberless quantities; 'one single sudden change can reduce thousands of mice to the number of a few individuals.' On the other side, a warm winter, or a winter which gradually steps in, make them multiply in menacing proportions, notwithstanding every enemy; such was the case in 1876 and 1877.[27] Competition, in the case of mice, thus appears a quite trifling factor when compared with weather. Other facts to the same effect are also given as regards squirrels.

On the other side, the contagious diseases which continually visit most animal species destroy them in such numbers that the losses often cannot be repaired for many years, even with the most rapidly multiplying animals. Thus, some sixty years ago, the *sousliks* suddenly disappeared in the neighbourhood of Sarepta, in South-Eastern Russia, in consequence of some epidemics; and for years no *sousliks* were seen in that neighbourhood. It took many years before they became as numerous as they formerly were.[28]

Like facts, all tending to reduce the importance given to competition, could be produced in numbers. Of course, it might be replied, in Darwin's words, that nevertheless each organic being 'at some period of its life, during some season of the year, during each generation or at intervals, has to struggle for life and to suffer great destruction,' and that the fittest survive during such periods of hard struggle for life. But if the evolution of the animal world were based exclusively, or even chiefly, upon the survival of the fittest during periods of calamities; if natural selection were limited in its action to periods of exceptional drought, or sudden changes of temperature, or inundations, retrogression would be the rule in the animal world. Those who survive a famine, or a severe epidemic of cholera, or small-pox, or diphtheria, such as we see them in uncivilised countries, are neither the strongest, nor the healthiest, nor the most intelligent. No progress could be based on those survivals—the less so as all survivors usually come out of the ordeal with an impaired health, like the Transbaikalian horses just mentioned, or the Arctic crews, or the garrison of a fortress which has been compelled to live for a few months on half rations, and comes out of its experience with a broken health, and subsequently shows a quite abnormal mortality. All that natural selection can do in times of calamities is to spare the individuals endowed with the greatest endurance for privations of all kinds. So it does among the Siberian horses and cattle. They *are* enduring; they can feed upon the Polar birch in case of need; they resist cold and hunger. But no Siberian horse is capable of carrying half the

[27] Dr. B. Altum, *ut supra*, pp. 13 and 187.

[28] A. Becker in the *Bulletin de la Société des Naturalistes de Moscou*, 1889, p. 625.

weight which a European horse carries with ease; no Siberian cow gives half the amount of milk given by a Jersey cow, and no natives of uncivilised countries can bear a comparison with Europeans. They may better endure hunger and cold, but their physical force is very far below that of a well-fed European, and their intellectual progress is despairingly slow. 'Evil cannot be productive of good,' as Tchernyshevsky wrote of late in a remarkable essay upon Darwinism.[29]

Happily enough, competition is not the rule either in the animal world or in mankind. It is limited among animals to exceptional periods, and natural selection finds better fields for its activity. Better conditions are created by the *elimination of competition* by means of mutual aid and mutual support. In the great struggle for life—for the greatest possible fulness and intensity of life with the least waste of energy—natural selection continually seeks out the ways precisely for avoiding competition as much as possible. The ants combine in nests and nations; they pile up their stores, they rear their cattle—and thus avoid competition; and natural selection picks out of the ants' family the species which know best how to avoid competition, with its unavoidably deleterious consequences. Most of our birds slowly move southwards as the winter comes, or gather in numberless societies and undertake long journeys—and thus avoid competition. Many rodents fall asleep when the time comes that competition should set in; while other rodents store food for the winter, and gather in large villages for obtaining the necessary protection when at work. The reindeer, when the lichens are dry in the interior of the continent, migrate towards the sea. Buffaloes cross an immense continent in order to find plenty of food. And the beavers, when they grow numerous on a river, divide into two parties, and go, the old ones down the river, and the young ones up the river—and avoid competition. And when animals can neither fall asleep, nor migrate, nor lay in stores, nor themselves grow their food like the ants, they do what the titmouse does, and what Wallace has so charmingly described: they resort to new kinds of food—and thus, again, avoid competition.

'Don't compete!—competition is always injurious to the species, and you have plenty of resources to avoid it!' That is the *tendency* of nature, not always realised in full, but always present. That is the watchword which comes to us from the bush, the forest, the river, the ocean. 'Therefore combine—practise mutual aid! That is the surest means for giving to each and to all the greatest safety, the best guarantee of existence and progress, bodily, intellectual, and moral.'

[29] *Russkaya Mysl*, Sept. 1888: 'The Theory of Beneficency of Struggle for Life, being a Preface to various Treatises on Botanics, Zoology, and Human Life,' by an Old Transformist.

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That is what Nature teaches us; and that is what all those animals which have attained the highest position in their respective classes have done. That is also what man—the most primitive man—has been doing; and that is why man has reached the position upon which we stand now, as we shall see in a subsequent paper devoted to mutual aid in human societies.

P. KROPOTKIN.