

power which wearies and wears, and cannot be continuously employed in a single direction without fatigue. The wise Solomon saw that much study is a weariness to the flesh. And modern physiologists have not failed to see that undue manual labor impoverishes and enfeebles the mind.

The will concentrated long upon compelling the muscles to perform a certain routine of movement, finds itself at length powerless to command. It must then cease exertion entirely as in sleep, or it must exert itself in some new direction. This is what is commonly called recreation, that is, an occupation which affords an agreeable contrast to that which has caused fatigue.

We think it is indisputable that any employment which exacts moderate muscular activity, at the same time interesting the mind by employing its powers upon such topics as do not arouse the animal passions, while they moderately engage the higher mental powers, has in it all the elements of healthy recreation. In our opinion nothing whatever so combines these elements and furnishes so cheaply the needed relief to professional men and hard students as some mechanical occupation, in which originality of design may be united with manual skill in execution.

In such recreation the entire tendency is to gratefully relieve the mind, gently exercise and invigorate the body, and build out and cultivate powers which cannot be developed to the moral hurt of the individual, but greatly increase his intellectual stature.

In such occupations the mind wearied with business cares, or by much study, may revel in refreshing beauties of form, color, and motion, and find the highest of all pleasures in the contemplation of the relation of simple causes to complex effects.

A man who has in this way attained to even moderate skill, may find his lathe a magical instrument by which he can clothe the rudest materials with forms of beauty, and gratify to the utmost that wonderful combination of faculties by which man most asserts his superiority over the brutes.

Imagination here finds, if not so wide a scope as in poetry, or the fine arts, sufficient to give it ample employ, and to banish from the mind all evil thinking and day dreaming, which to the young mind is always hurtful and sometimes fatal.

On this latter account we recommend most earnestly mechanical recreation for the young. Let the boys build windmills and miniature dams. They soil their clothes, but how much better soiled garments than soiled minds. They may cut their fingers with the tools you permit them to employ, but you will find such wounds heal in less time than the foul ulcers of moral corruption.

Every man who can afford it should supply his boys with tools, and a room where they may be used and cared for. A boy takes to tools as naturally as to green apples, or surreptitious and forbidden amusements; and ten to one if he has a chance to develop his mechanical tastes and gratify them to their full extent, his tendencies to vicious courses will remain undeveloped. Such a result is enough to compensate for all the expense and trouble the indulgence we recommend would entail; while the chances that the early development of his constructive faculties may in this mechanical age be the means by which he may ultimately climb to fame and fortune are not small.

CURIOUS ASSOCIATIONS AMONG ANIMALS.

In the palmy days of Barnum's Museum, one of its chief attractions was what was called "The Happy Family," composed of a large number of abjectly miserable animals, generally supposed to have a natural antipathy for each other's society, living together on compulsion, and whose manifestations of stupid tolerance were accepted by the country visitors to that great institution, as indisputable evidence of their blissful state of mind, and the regenerate condition of their hearts.

Once, while on a visit to the collection alluded to, we remarked a good clergyman, evidently hailing from some remote rural location, highly delighted in the contemplation of "The Happy Family," who remarked, somewhat in the style of the venerable Chadband, "Herein we see a type of the fulfillment of the blessed prophecy, that the 'Lion shall lie down with the lamb.'"

Just at the moment, one of the keepers chanced to pass. At the sight of his familiar face, the wretched little dog—whose confinement had not obliterated fond memories of past days, when he might roam and frisk at will, and choose his own society—rushed frantically to the bars of the cage with doleful cries and piteous pleadings, thrusting out his helpless little paws in vain appeal to be released. It was quite affecting to witness the expression of stolid despair in his little brute countenance, when he found no notice was taken of his petition, and the desperate way in which he walked to a partially secluded corner and threw himself prone, as though all hope had fled. The little episode was not without its effect upon the bystanders; and the clergyman referred to, evinced his goodness of heart by loudly denouncing the affair as a cruel exhibition, in which verdict we heartily concurred.

If the reader will follow us for a little while, we will introduce him to some more curious associations than Barnum's Museum ever displayed; associations originating in the common interest of the parties to them, or in the desire to relieve the oppressive sense of solitude which even the lower animals seem to feel.

The well-known associations of parasites with the animals upon whom they prey, are the most unpleasant and disgusting, as they are the most familiar examples of animal companionships. These are only in the interest of one of the parties, and are generally strongly objected to by those who thus find disagreeable company thrust upon them.

We shall find a more pleasant, if not a more instructive field of contemplation in those voluntary associations and attachments which animals of different species form with and for each other.

Foremost among these is the companionship of domestic animals with man. Familiar as household words are the innumerable stories of faithful attachments mutually existing between man and the dumb creatures, which so largely contribute to his sustenance, protection, and pleasure.

Scarcely less familiar are the stories of apparently incongruous attachments between dogs and cats, cats and mice, fowls of different species, etc. Riding once along one of the pleasant drives radiating from Saratoga Springs, we saw the comical spectacle of a pig sweetly sleeping, literally in the arms of a fond calf. These two creatures, cut off from all society by the external limits of a lonely farmyard had become all in all to each other, and shared their "bit and sup," and their quiet couch in the sunny corner, with mutual satisfaction. Very many similar instances of unusual attachments between domestic animals might be enumerated, but we wish, more particularly, to call attention to such associations as are made, apparently through the instinctive consciousness that a common benefit may accrue from a union of diverse gifts and powers.

For this purpose we find a rich collation of facts, ready to hand, in a paper not long since read before the Belgian Academy, by P. J. Von Beneden, on "Animals as Fellow Boarders." We are told, that the *Donzelle*, a graceful little fish, found in different seas, takes up its abode in the stomachs of the sea cucumbers, and that these lodgings are shared by prawns and pea crabs, dining together on the abundant stock of food which the sea cucumbers—being excellent fishers—provide.

In the Indian seas, a modest little fish with an extensive scientific appellation, lodges habitually under a star fish, and feeds on the crumbs which fall from the table of his patron. A Siluroid, of Brazil, of the genus *Platyostoma*, lodges a species of very small fish in its mouth and shares its daily food with its *protège*.

Other instances of mouth lodgers might be mentioned; even Crustacea taking advantage, in this way, of the superior predatory ability of more active creatures. In the China seas Dr. Collingwood found an anemone, in whose interior little fish resided, whose name he did not know, but which seemed content and happy in their curious abode. The pea crab lives in mussel shells, and picks up a comfortable living without in the least injuring its hospitable entertainers. The ancients, we are told, thought that the mollusks, having no eyes, were glad to avail themselves of these little crabs, but the probabilities are, that the crabs eyes are employed solely for their own benefit. Like other crustaceans, of the same rank, says Von Beneden, "these little creatures carry on each side of the shell, at the end of a movable stalk or support, a charming little globe, furnished with hundreds of eyes, which they can direct, as an astronomer turns his telescope, to any part of the firmament. What cannot be doubted is, that the little intruders live on perfectly good terms with the mussels and if the latter supply a convenient and safe lodging, they, on their side, profit largely by the morsels which fall from the claws of their guests, who are well placed and well provided with prey-catching apparatus. Snugly seated in their living house at the bottom of the sea, they possess a movable lair which the mussel carries about, and they can choose the best moment for attack, and fall upon the enemy unawares."

But the most remarkable instance of association for mental profit, is that of the hermit crab. These creatures are decapod crustaceans, somewhat resembling miniature lobsters, who make their abode in deserted shells, and change both their skin and their dwelling as they increase in size. The young ones are contented with very small habitations. The shells they inhabit are derelicts they find at the bottom of the sea, and in which they conceal their weakness and personal disadvantages with obstinate persistence.

These singular creatures have too soft an abdomen to confront the dangers they encounter in their incessant wars, and the shells in which they thrust themselves supply at once lodgings and shields. Armed thus from head to foot the soldier crab marches proudly against his enemies, and fears no danger, because he has a secure retreat. But this soldier, or hermit crab, is not alone in his dwelling. He is not an anchorite like those dwelling in air, for by his side a worm is commonly installed as fellow-boarder with him, forming one of the most remarkable associations which is known. The companion worm is elongated like all the Nereids, and its supple, undulating body is armed along its sides with bundles of lances, pikes, and daggers, the wounds from which are very dangerous. The crab, ensconced in his borrowed armor, and flanked by his terrible acolyte, attacks all he finds before him, and knows no reverse. Thus, around his domain, we observe a prosperity not seen elsewhere, and on his shell there usually flourishes a whole colony of Hydractinia, blooming like a flower-bed, and inside we often find Peltogaster, Lyriope, and other Crustaceans, who convert it into a true pandemonium.

Besides many other associations formed with various species of soldier crabs, there are barnacles, which lodge on the skin of the whale, in company with whale lice and other marine creatures, worms which live as companions in the same sheath with their congeners, and even with included mollusks; creatures which live in freedom in their youth, but, when they approach to maturity, throw away their legs and eyes, change their clothes, and attach themselves permanently to some animal upon which they are ever after wholly dependent.

The Remora, an animal found in the waters of the Mediterranean, attaches itself with vigor to other animals by means

of an apparatus attached to its head, and the inhabitants of Mozambique make use of this habit to entrap fish and other marine animals. They catch Remoras, put rings in their tails, attach lines to the rings, and cast the Remoras forth into the sea. Presently the Remora will have stuck to something and is drawn in by the tail, holding fast to the creature it has unintentionally brought to grief.

But we cannot dwell longer upon these curious associations. Our readers will agree with us, that they afford food for much profitable reflection, and that they may instruct as well as amuse. They teach how ample is the provision made for the sustenance and protection of the myriad creatures which people our globe, and lead to the belief that these wondrous provisions cannot be alone confined to this little mustard seed of a planet, among the magnificent heavenly bodies that circle together around the great life-giving, life-sustaining sun.

CHEMISTRY OF ZIRCONIUM.

Dr. Ernest Melliss has published "Contributions to the Chemistry of Zirconium" that contain much new matter; and as this element is now employed in the zirconium light, it may be of interest to know something more about it than we can learn from any books on chemistry.

There are scarcely more than a dozen minerals that contain zirconium, the most important of which is the zircon, which is so called because it was used as a false jewel, and received the name jargon, or zircon, from dealers in precious stones. There are fine specimens of this mineral in North Carolina, New York, New Jersey, and Pennsylvania.

The pure zircon contains 66.96 per cent oxide of zirconium and 33.04 per cent silica; its specific gravity is 4.05 to 4.75. From this mineral the metal zirconium and all of its compounds are prepared. It is heated to redness and quenched in water so as to be easily pulverized, and the fine powder is mixed with four times its weight of carbonate of soda, and fused in a platinum crucible. The mass from the crucible is treated with hydrochloric acid, evaporated to dryness to separate the silica, again dissolved, and the oxide of zirconium precipitated by ammonia.

By mixing the powdered zircon with carbon, and passing chlorine gas over it, the chloride of zirconium can be formed along with the chloride of silicon, which latter being very volatile, can be expelled by heat, leaving behind the zirconium salt nearly pure.

The resolution of the mineral by fluoride of potassium has also been recommended, but the best method appears to be to fuse it with bisulphate of potash, and thus on subsequent treatment with sulphuric acid to convert it into pure basic sulphate of zirconia.

The reducing agent employed in the preparation of metallic zirconium is aluminum, and the operation is interesting as being applicable to other metallurgical processes. The double fluoride of zirconium and potassium is first prepared by dissolving the oxide in hydrofluoric acid and pouring the liquid into a concentrated solution of neutral fluoride of potassium. The precipitate thus formed is well dried and intimately mixed with twice its weight of finely-divided aluminum, and exposed in a gas carbon crucible to a heat sufficient to melt copper.

The zirconium will be found in the form of leaves and scales penetrating the aluminum, which remain after dissolving out the aluminum by hydrochloric acid. The metal is hard, and crystalline, like antimony, with the specific gravity of 4.15. It is said to exist in three states the same as silicon and boron, namely, amorphous, graphitoid, and crystalline, and is less fusible than silicon, and burns only at the temperature of the oxyhydrogen blow pipe.

No uses have thus far been suggested for zirconium, and, in fact, it has been too little studied to enable us to speak with certainty about it. In consequence of some of its chemical relations it is now classed with tin, titanium, thorium, columbium, and tantalum; while by other writers it is put in the same group with carbon, boron, and silicon, instead of with aluminum as formerly.

The oxide of zirconium is now employed to point the pencils used in the oxyhydrogen light. It is said not to waste away as magnesia and lime do; but the cost of the oxide and the trouble to prepare it must stand in the way of its general adoption.

Dr. Sorby about a year since published an account of the discovery of a new metal associated with zirconium, which he called "jargonium," but recently he announced his mistake. The reactions attributed by him in the first instance to jargonium he now finds are, in fact, owing to the presence of a small quantity of the oxide of uranium in the mineral zircon, and the supposed new metal must therefore be erased from our list. The compounds of zirconium have thus far no interest in the arts.

SCIENTIFIC INTELLIGENCE.

HEATING WITH GAS.

MM. Jacquet and Hauteur, in Paris, have invented a method for heating with gas by reflection, which seems to offer some advantages over previous attempts in this direction. The gas burns with inverted flame, and a double hearth below the burner to absorb all of the products of combustion. The hearth, which is not in sight, throws off all of its heat and light by reflection from a series of mirrors made of red copper, and the effect is said to be remarkable. It is difficult without diagrams to convey a perfect idea of the invention, which is said to be applicable to all kinds of cooking and heating purposes.

TEST FOR SMALL QUANTITIES OF ALCOHOL.

A few drops of the liquid to be tested are poured into a