by only three or four sheets of paper. The surfaced face was then placed against the stone to be cast, which had previously been thoroughly wet with water, and beaten in with a stereotyper's brush. In the case of vertical surfaces it was found necessary to rub some of the stripped backing into a maché and use daubs of it to hold the upper surface in place until the paper was beaten into the engraving. There was found to be sufficient give to the paper to beat into half-inch recesses without tearing. In cases where tearing occurred, as in deep relief or half-inch relief with close vertical sides, the tears were patched by applying small pieces of the stripped back sheets. When this first surface was complete, the deep recesses were filled with a pulp made by rubbing up the stripped back sheets. The excess moisture was then pressed out with the fingers and a sheet of backing patted on as an outer surface. A piece of wet bagging was then laid over the cast and the impression allowed to dry in place. At the time of year we were working, this took between three and six hours, depending upon the time of day and the depth of the relief. When dry the impressions were removed.

In the case of deep relief, it was found wise to finger the first surface to be sure it was in perfect contact with the stone at all points before filling in the recesses. The mats were successfully applied to reliefs ranging in depth from one fourth to a little over one inch. Absolutely no damage was observed to occur to the originals.

There are several distinct advantages for these casts. They are light, extremely durable, of excellent definition recording faithfully the finer detail, inexpensive, easy to manipulate and safe to use. Positives may be taken from them in plaster, glue and gelatine, or type metal.

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SPECIAL ARTICLES

THE OCCURRENCE OF THE PARALYTIC SHELL-FISH POISON IN THE COMMON SAND CRAB[1]

DURING studies of the past five years the paralytic poison which causes sporadic cases of illness and even death in humans after consumption of certain shellfish has been found in the Pacific Coast mussel, *Mytilus californianus,* and in most of the edible clams.[2] Of these, the varieties which are found along the open ocean shore (*Siliqua patula,* razor clam) and near the inlets of bays (*Saxidomus nuttallii,* Washington clam, and *Schizothaerus nuttallii,* horseneck clam), may be dangerously toxic, while *Paphia staminea* (quahog) usually contains less of the poison. *Mytilus edulis* (bay mussel) *Mya arenaria* (softshell clam) and *Ostrea lurida* (the native Pacific oyster), which grow at greater distances from the open ocean, have never yielded toxic extracts. It would be expected that animals which live in close contact with the harmful shellfish might be slightly poisonous, especially since recent experiments have shown that *Mytilus californianus* excretes the poison into the sea water under laboratory conditions. But in none other than bivalves had the toxic substance been demonstrated so far to any considerable amount.

During the recent outbreaks, however, of mussel and clam poisonings—June and July, 1932—tests on the small sand crab *Emerita analoga* (Stimpson) revealed the presence of the paralytic shellfish poison in high concentration in this crustacean. The table shows that animals of any size were poisonous. No difference was found in crabs remote from, or adjoining mussel beds. Analyses of separate parts of the body showed clearly that the poison is concentrated in the intestinal organs, probably the liver, as in the bivalves. The small amount found in other parts, especially in the gonads, must be attributed to dissemination of the poison during the dissection of the small animals. Due to their smaller size the males could not be tested separately as to toxicity of the gonads and the liver; the results in this instance refer to large female crabs. If the liver extracts of *Emerita analoga* from various places are compared with those of the livers of *Mytilus californianus* from near-by mussel beds the fact stands out clearly that both animals are roughly of the same toxicity at the same time. The poison from crabs gives symptoms identical with those from mussel poison when injected intraperitoneally or fed to white mice.[3] The chemical properties likewise are in close agreement; the poison from both animals is readily soluble in water and alcohol, insoluble in ether and chloroform. Boiling with dilute alkali destroys its potency irreversibly, while it is stable in acid solution.

These findings are of significance in various respects. From the practical standpoint of public health it is important to have a readily available

[1] From the George Williams Hooper Foundation, University of California, San Francisco, California.

[2] See preliminary report by K. F. Meyer, *Am. Jour. Pub. Health,* Vol. 21, p. 767, 1931.

[3] M. Prinzmetal, H. Sommer and C. D. Leake, *Jour. Pharmacol.,* 1932, Vol. 46, p. 63.

Date	Locality	Average Lethal Doses of Extracts of				
		Mytilus californianus Livers only	*Emerita analoga*			
June 14	San Francisco Beach	.....	Whole animals*	2.5	mg.	
17	" " "	.....	" "	5.0	"	(large specimens)
			" "	2.0	"	(small ")
18	Musselrock (San Mateo County)	0.12 mg.	" "	2.0	"	
21	Salmon Creek (Sonoma County)	10 "	" "	> 60	"	
23	Musselrock	0.2 "	" "	10	"	(large specimens)
			" "	6	"	(medium ")
			" "	6	"	(small ")
26	Muir Beach (Marin County)	0.2 "	" "	2.5	"	(small ")
26	Bolinas Beach (Marin County)	0.15 "	" "	2.2	"	(small ")
29	San Francisco Beach	.....	Eggs	3	doses	eight large females
			Muscles	10	"	
			Viscera	250	"	
July 4	Musselrock	0.2 mg.	Gonads	2.5	mg.	
			Livers	0.6	"	
4	Montara (San Mateo County)	0.2 "	Viscera	0.35	"	
4	Miramar (San Mateo County)	.....	Gonads	1.5	"	
			Livers	0.15	"	
5	Salmon Creek	0.1 mg.	Livers	0.12	"	
19	La Jolla † (San Diego County)	.....	Livers	> 60	"	
20	San Francisco Beach	2.0 mg.	Livers	0.6	"	

* The ratio of weights of liver extract to extract of whole crabs is approximately 1: 10. For a comparison the values given for whole animals have to be divided by 10.

† For this sample I am indebted to Dr. C. E. ZoBell, of the Scripps Institution of Oceanography.

animal the analysis of which will indicate the approach of a "toxic period." Mussels and clams are obtainable only at low tide, during a short time of the day, in limited parts of the coast, while sand crabs can be collected at practically any tide level, every day of the month and at any locality along the coast. Furthermore, the results demonstrate that at some time during the summer months the paralytic shellfish poison is likely to be prevalent in unexpectedly large amounts along the California Coast, since the crab is found in large numbers on any sandy beach. The view held so far that the poison is confined to certain bivalves is no longer tenable. At least this decapod, which, like the mussel, feeds on the plankton of the shore,[4] seems to concentrate or form the poison in the digestive gland. In this connection it is of interest to record that sand crabs kept in aerated sea water in the laboratory for 24 hours gave off measurable amounts of poison into the water. The underlying sand, which had been completely washed free of electrolytes with distilled water, yielded another amount of poison after elution with concentrated salt solution. Further studies of these equilibria and of the toxicity and biology of *Emerita analoga* in conjunction with those on *Mytilus californianus* are expected to be of great help in the elucidation of the intricate problem of mussel poisoning.

[4] F. W. Weymouth and C. H. Richardson, Jr., *Smithson. Miscel. Collect.*, 1912, Vol. 59, No. 7, Publ. 2082.

SUMMARY

The paralytic shellfish poison may be found in a high concentration in the sand crab *Emerita analoga*.

HERMANN SOMMER

THE OCCURRENCE OF MOTTLED TEETH IN IOWA[1]

BLACK and McKay[2] in 1916 were among the first who called attention to mottled teeth in certain areas of this country. Some relationship was suspected between the condition and the drinking water of those regions. Until recently, however, no common characteristic of the waters from affected regions was observed, and, consequently, the causal agent of the disturbance in the structure of the teeth remained unknown.

[1] From the Laboratories of Physiological Chemistry and Physical Chemistry, Iowa State College, Ames, Iowa. Dr. Carl T. Ostrem, Ankeny, Iowa, cooperating.

[2] Black and McKay, *Dental Cosmos*, 58: 129–156, 1916.