This phenotypic relation occurs in populations of widely differing genetic backgrounds as shown in Table 2. The data for each of the three breeds and their crosses are in accord that *M* is equivalent to ka^h and *m* is equivalent to Ka^L, but the precise nature of this equivalence remains to be determined.

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Deamino-Oxytocin and 1-γ-Mercaptobutyric Acid–Oxytocin: X-ray Crystallographic Data

Abstract. *X-ray studies of crystalline deamino-oxytocin (1-β-mercaptopropionic acid–oxytocin) have established the existence of both wet and dry forms. A remarkable degree of similarity exists between the two forms even though there are changes in cell dimensions and space group on drying. The dry form of 1-γ-mercaptobutyric acid–oxytocin is very similar to that of deamino-oxytocin.*

Deamino-oxytocin (1-β-mercaptopropionic acid–oxytocin) and 1-γ-mercaptobutyric acid–oxytocin were both first crystallized from 1*N* acetic acid by Jarvis and du Vigneaud (*1*). Ferrier, Jarvis, and du Vigneaud have shown that both compounds can be crystallized from water (*2*). Deamino-oxytocin exerts some of the pharmacological activities of oxytocin to an even greater degree than does the hormone itself, whereas 1-γ-mercaptobutyric acid–oxytocin is virtually inactive.

Using a slight modification of their procedure, slow cooling over a narrower temperature range, we have obtained much larger crystals (0.4 × 0.08 × 0.01 mm) of deamino-oxytocin. These crystals are monoclinic laths, elongated along *b*, lying on (001), and frequently terminated by complex high-order forms. The uniterminal character of the diad axis is usually evident. On standing in air, the main face of the crystal loses brilliance and appears eroded. A discrete air-dried stage has been defined.

Table 1. Data for deamino-oxytocin and 1-γ-mercaptobutyric acid–oxytocin.

Form	Unit cell dimensions					Space group	Measured density (D_m) (g/ml)
	a Å	*b* Å	*c* Å	β °	*V* (10^{30} Å^3)		
			Deamino–Oxytocin				
Wet	27.3 ± .1	9.07 ± .03	23.1 ± .1	102.4 ± .3	5.60 ± .06	$P2_1$	1.305 ± .005* 1.328 ± .005†
Dry	28.1 ± .2	9.43 ± .06	24.5 ± .2	124.0 ± .3	5.38 ± .10	*C*2	1.328 ± .005
			1-γ-Mercaptobutyric acid–oxytocin				
Dry	28.0 ± .2	9.24 ± .06	24.3 ± .2	121.4 ± .3	5.35 ± .10	*C*2‡	1.319 ± .005

* Measured in aqueous column. † Measured in water-saturated xylene-bromobenzene column. ‡ More probable of two possible space groups.

We have examined only a preparation of the air-dried form of 1-γ-mercaptobutyric acid–oxytocin. The crystals were small, and many of them were fragmented. They are thin monoclinic plates, elongated along *b*, and lying on (001).

X-ray crystallographic data for both the wet and the dry forms of deamino-oxytocin and the 1-γ-mercaptobutyric acid–oxytocin were obtained from oscillation, Weissenberg, and precession photographs; CuK_α radiation was used. The densities were determined by a modification of the normal density-gradient-tube procedure (*3*). The gradient tube was viewed between crossed sheets of Polaroid in order to determine the position of the extremely small samples of the colorless crystals. By this technique, a density determination was possible with a few crystals of total weight approximately 10μg. These crystals could not be seen in the gradient tube without the aid of the crossed Polaroid sheets. The results of the x-ray and the density studies are shown in Table 1.

When deamino-oxytocin crystals are dried, there is not only a change in cell dimensions but also a change in space group from $P2_1$ in the wet form to *C*2 in the dry form. However, this change is not so significant as it might appear, since the intensity distribution of the 0*kl*, *hk*0, and *h0l* reflections of the wet form of deamino-oxytocin all showed marked pseudo face-centering related to the face-centering exhibited by the dry form.

The density of the wet deamino-oxytocin crystals was determined in both water-saturated xylene-bromobenzene and aqueous columns. The density (1.305 g/ml) obtained with the aqueous column leads to a value of 2210±40 for the molecular weight of the asymmetric unit. This corresponds to two molecules of deamino-oxytocin ($C_{43}N_{11}O_{12}H_{65}S_2$, molecular weight: 991) and 12±2 molecules of water. The density (1.328 g/ml) obtained with the water-saturated xylene-bromobenzene column leads to a value of 2242±40, corresponding to two molecules of deamino-oxytocin and 14±2 molecules of water. The air-dried form of deamino-oxytocin has a density of 1.328 g/ml which leads to an asymmetric unit weight of 1077±30, corresponding to one molecule of deamino-oxytocin and 5±2 molecules of water. In the normal transition from the wet to the air-dried state in proteins and large peptides, water is lost and there is a corresponding decrease in the volume of the crystal. The loss of some of the aqueous component of higher partial specific volume leads to an increase in density. The existence of an air-dried form with a measured density of 1.328 g/ml therefore suggests very strongly that for the wet form the lower value of the density found in the aqueous column should be considered more probable. Water could be lost from the crystals in the xylene-bromobenzene column. The volumetric change observed on drying is compatible with a loss of either three or four molecules of water per two molecules of deamino-oxytocin (the asymmetric unit in the wet form).

The wet crystals of deamino-oxytocin give good diffraction patterns. The minimum spacing observed was 1.1 Å. The dry crystals are markedly disordered with a minimum spacing of 1.8 Å. These crystals are highly mosaic with

an angular distribution of crystallites of at least 5°. When mounted dry, the crystals appear to bend and this may contribute to the high degree of mosaicity.

The air-dried crystals of 1-γ-mercaptobutyric acid–oxytocin examined gave rather poor diffraction patterns. The reflections observed (0*kl*, *h*0*l*, *hk*0, *hk*1) are compatible with the space group $C2$. Because of the poverty of the diffraction pattern, marked pseudo face-centering with a space group $P2_1$ cannot be eliminated. The crystals have a density of 1.319 g/ml which leads to an asymmetric unit weight of 1062 ± 30. This corresponds to one molecule of 1-γ-mercaptobutyric acid–oxytocin ($C_{44}N_{11}O_{12}H_{67}S_2$, molecular weight: 1005) and 3 ± 2 molecules of water.

The remarkable similarity, not only in the cell dimensions but also in the intensity distribution in the principal planes, between the wet and dry forms of deamino-oxytocin (1-β-mercaptopropionic acid–oxytocin) and that of 1-γ-mercaptobutyric acid–oxytocin suggests that the insertion of a methylene unit into the ring structure may not grossly affect the overall molecular conformation.

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Maximum Diving Capacities of the Weddell Seal, Leptonychotes weddelli

Abstract. *The probable maximum diving capacities of the Weddell seal were ascertained from observation of 959 dives and measurement of the depths of 381 dives. The deepest dive was 600 meters; the longest submergence was 43 minutes 20 seconds.*

Most information that biologists have obtained about marine mammals deals with their breeding behavior while on land or their habits while held captive in aquaria. The behavior of these mammals at sea—the depth of their dives, the duration of their submersion, and their feeding habits—has usually been observed fortuitously; measurement has been indirect and the samples small. For example, Collett reports a young gray seal being caught on hook and line at 146 m (*1*). There are similar reports for the harp seal at 275 m (*2*), the Alaskan fur seal and the Steller sea lion at 55 m and 183 m, respectively (*3*), and the northern elephant seal at 183 m (*4*). The only reports of experimental studies where seals had depth recorders attached are of a bladdernose seal pup which dove to 75 m (*5*) and of a Weddell seal which dove to 350 m (*6*). Field observations of lengthy submersions are scarce; they include reports of a 21-minute dive for the ringed seal (*7*) and a 16.5-minute dive for the Weddell seal (*8*). In the laboratory the bladdernose seal has endured forced submersion for 18 minutes, the gray seal for 18 minutes (*5*), and the harbor seal for 23 minutes (*9*), and none with ill effects. In comparison to whales these reported capabilities of seals seem rather modest. A sperm whale became entangled in a deep-sea cable at a depth of 1134 m (*10*), and bottle-nosed whales have been observed to remain submerged for 2 hours after harpooning (*11*).

During the austral summers of 1963–64 and 1964–65, we conducted a 2-year experimental investigation of the diving capacities and the behavior of the Weddell seal, *Leptonychotes weddelli*. The study area was near the U.S. Antarctic base at McMurdo Sound, which was particularly suitable for several reasons. Many seals are there during the summer months, they spend a great portion of their time diving under sea-ice which remains in good condition until late summer, a biological laboratory is established at the base, and U.S. Navy logistic support is readily available.

Four different types of instruments were used to monitor the seals' diving activities because each has certain advantages and disadvantages: (i) A Tsurumi-Seikikosaku (TSK) depth recorder, similar to the type used by DeVries and Wohlschlag (*6*), measures only the maximum depth of a dive. (ii) An ultrasonic (50-kcy/sec) depth transmitter indicates actual depth at any moment by a frequency transposed in the receiver into audible range by a reference oscillator and balanced modulator. This audible signal, in which frequency is proportional to the depth of the transmitter, was recorded on tape. The main disadvantages of this instrument are that it has a limited range for signal reception and that some of the seals seemed to be disturbed by the transmitter output signal. (iii) A manometer tube which records maximum depth only. (iv) A depth-time recorder which records depth against time on a smoked glass disc. The last two instruments are described in detail elsewhere (*12*). In addition to these recording devices, an under-ice observation chamber was used to observe the seals' behavior in some of the experiments during the second season of investigation.

The experiments were conducted at stations located on sea-ice in an area free from cracks and holes for a radius of approximately one mile and over water about 600 m in depth. Each station consisted of a heated hut placed over a hole cut in the ice, which was about 6 feet thick. For each experiment an adult seal was captured several miles away and brought to the station, where an instrument packet was attached to it. The animal was then released through the ice hole. When the seal returned to the hole for air, the instrument packet was removed and the data recorded. This experimental approach to obtaining information on the seals' maximum diving capacity had several advantages over that of observing the seals in their usual diving holes: (i) The seal was forced to return repeatedly to one particular breathing hole over several hours and, consequently, fewer instruments were lost during the measure-