This is a model based on Fourier's law of heat flow. The linear relation between the rate of heat flow at constant core temperature and the temperature difference between core and surface is what most physiologists, especially those dealing with homeotherms, have in mind when they write of Newton's law of cooling, thereby confusing cooling with heat flow and Newton with Fourier.

Strunk's critical analysis of the application of Newton's law of cooling to animal heat flow is a very valuable supporting addition to earlier critiques of erroneous statements involving this law. However, the use of "contemporary Newton's law" for a formulation that cannot be Newtonian, and of "Newtonian animal" for a system without internal heat production, which contradicts one of the most basic criteria of an animal, may become a source of confusion.

For the sake of semantic clarity and historical truth it would be much better to admit that a number of first-rate physiologists, biophysicists, and zoologists have erroneously called Fourier's law of heat flow Newton's law of cooling. This mistake should be recognized and, in future publications, avoided. A simple form of Fourier's linear law of heat flow in animals without loss of body temperature (homeotherms) should be clearly distinguished from Newton's exponential law of temperature loss of a cooling body. The "heat conductivity" of the insulating layer in Fourier's law may be expanded to "heat transferability," and likewise "conductance" to its reciprocal, "resistance to heat flow." This extension makes Fourier's law of heat flow similar to Ohm's law of the flow of electrons.

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## Crystal Structure of Krypton Difluoride at −80°C

Abstract. *Krypton difluoride is tetragonal, space group* $P4_2/mnm$, *with two linear molecules per unit cell aligned in planes perpendicular to the tetrad axes. The alignment alternates by 90 degrees between successive planes. The krypton-fluorine bond distance is 1.89 ± 0.02 angstroms.*

Crystals of $KrF_2$ at room temperature were studied by x-ray diffraction by Siegel and Gebert (*1*) with limited results. They reported a tetragonal lattice with unit cell parameters $a = 6.533$ Å and $c = 5.831$ Å, but were not able to identify the space group symmetry. Since $KrF_2$ is the only fully established binary compound of Kr it is important to know its crystal structure. We here report the $KrF_2$ structure as determined from low-temperature x-ray diffraction techniques.

Krypton difluoride was prepared by the method of Schreiner *et al.* (*2*). The material was distilled into a fluorinated ethylene propylene copolymer capillary (30 cm long, 1 mm outer diameter) and crystallized in a cold gas stream. A section 2 cm long containing a crystal was sealed off by keeping the section under liquid nitrogen while using the sealing torch above the liquid nitrogen surface. The specimen was stored in liquid nitrogen until it was placed in a cold gas stream on the x-ray apparatus.

The initial crystal was sublimed and recrystallized several times in a variety of crystallographic orientations relative to the capillary axis. Diffraction data were recorded at about −80°C by using a precession camera. The crystal symmetry was confirmed as tetragonal from Polaroid photographs of six zero levels and one upper level of the reciprocal lattice with a [100] orientation along the spindle axis (*3*). The unique reflections of observable intensity were 10 *hk*0, 14 0*kl*, 2 *hhl*, and 18 *hkl* reflections. The space group extinctions are 0*kl* absent unless $k + l = 2h$. The possible space groups are $P4_2/mnm$, $P\bar{4}n2$, and $P4_2nm$. The unit cell constants are

$a = 4.585$ Å $\quad V = 122.5$ Å$^3$
$c = 5.827$ Å $\quad Z = 2$
density = 3.301 g cm$^{-3}$

where $V$ is the volume and $Z$ the number of formula units in the unit cell. The $a$ axis reported by Siegel and Gebert (*1*) is $2^{1/2}$ times longer than the true axis.

Visually estimated intensities of 20 reflections were obtained from the *hll* level of a crystal with a [011] orientation (*4*) and approximate dimensions of 0.2 by 0.1 by 0.1 mm. The data were corrected for the Lorentz and polarization effects but not for absorption. The structure was solved by placing Kr at 0,0,0 and F at $x,x,0$ in space group $P4_2/mnm$ (*5*) with $x = 0.2902$. The trial parameter was obtained by assuming

$$d_{Kr\text{-}F} = d_{Xe\text{-}F}(V_{KrF_2}/V_{XeF_2}) = 1.882 \text{ Å}$$

where $d_{Xe\text{-}F} = 2.00$ Å is the bond distance and $V_{XeF_2} = 130.15$ Å$^3$ is the unit cell volume as reported by Levy and Agron (*6*) for $XeF_2$. The structure was refined with the least squares program of Busing *et al.* (*7*) to the values $R = 0.053$ and $wR = 0.058$ for the agreement index and the weighted agreement index, with a single isotropic thermal parameter, $B$. A comparison of the observed and calculated structure factors is given in Table 1. The final parameters are $x = 0.2909$ (0.0032) and $B = 2.54$ (0.16) Å$^2$, where the

Table 1. Observed and calculated structure factors, $F_o$ and $F_c$, for $KrF_2$.

| *hkl* | $F_o$ | $F_c$ | *hkl* | $F_o$ | $F_c$ |
|---|---|---|---|---|---|
| 011 | 107 | 105 | 222 | 85 | 85 |
| 022 | 52 | 52 | 233 | 34 | 36 |
| 033 | 64 | 67 | 244 | 25 | 24 |
| 044 | 36 | 37 | 311 | 22 | 17 |
| 111 | 51 | 49 | 322 | 7 | 6 |
| 122 | 23 | 15 | 333 | 7 | 5 |
| 133 | 16 | 12 | 400 | 57 | 59 |
| 144 | 7 | 7 | 411 | 49 | 45 |
| 200 | 61 | 59 | 422 | 35 | 32 |
| 211 | 91 | 96 | 433 | 29 | 29 |

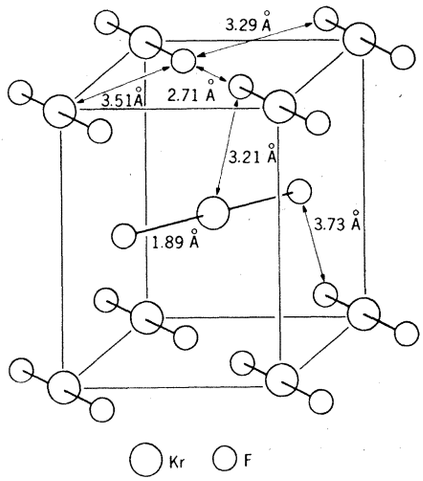


Fig. 1. Crystal structure and interatomic distances of $KrF_2$.

standard deviations are in parentheses.

Figure 1 illustrates the $KrF_2$ crystal structure. The linear molecules are aligned in planes perpendicular to the tetrad axes. The alignment alternates by 90° between successive planes. The Kr-F bond distance is 1.886 (0.021) Å. This may be compared with the gas phase electron diffraction value of 1.889 (0.010) Å (*8*) and the spectroscopic value of 1.875 (0.002) Å (*9*). The interatomic distances of interest are shown in Fig. 1. Each Kr atom has four F neighbors at 3.21 Å in adjacent planes and four F neighbors at 3.51 Å in the same plane. Each F atom has one close neighbor at 2.71 Å and two F neighbors at 3.29 Å in the same plane. Each F atom has eight neighboring F atoms at 3.73 Å in adjacent planes. The $KrF_2$ crystal structure presents an interesting contrast to the $XeF_2$ structure (*6*), in which the molecules are aligned parallel to the tetrad axes to form a body-centered arrangement (*10*).

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## Pancreatectomy in the Eel: Effects on Serum Glucose and Cholesterol

Abstract. *Pancreatectomy in the eel causes a slight tendency toward hyperglycemia; total and partial pancreatectomies cause a drop of total serum cholesterol. Thus, complete removal of the islet tissue in this teleost is not followed by diabetes mellitus, and also the endocrine control of the cholesterol-containing serum components seems to differ from that in mammals.*

The physiological role of the endocrine pancreas in fishes is very poorly understood (*1–4*), and the few data on pancreatectomy or isletectomy (*5, 6*) in teleosts are in part contradictory; in the latter, probably the only complete removal of all pancreas tissue was performed in the European eel, in which Caparelli, in 1894, found inconsistent glucosuria (*5*). All other authors removed the Brockmann bodies only, very likely leaving smaller islets with the remaining exocrine pancreas (*3*). Since the American eel (*Anguilla rostrata*) is the only teleost known to us to have all islet tissue concentrated in a compact pancreas (*7*), we studied the effects of pancreatectomy in this species on (i) serum glucose, as an indicator of diabetic alterations, and (ii) serum cholesterol, because of its high levels in some teleosts (*8*), in particular in the eel.

A total of 100 eels, ranging in weight from 36 to 108 g, were captured by net in the fall from freshwater near Philadelphia. Their coloration varied greatly, but all gonads were histologically undifferentiated. With regard to color, the animals were randomly distributed through the various experimental and control groups. For practical purposes, the animals were kept in aerated and filtered tap water at 14°C under dimmed continuous illumination. An acclimation period of several weeks was permitted before the surgical interventions, which started in December for the partially pancreatectomized animals (5 to 6 months group, Fig. 1), and all others in February ("winter-spring" animals). No food was given at any time. One additional group ($n = 9$) was captured in June and killed after 1 week in captivity ("summer controls"). Surgical techniques used were (i) total pancreatectomy, including partial removal of the portal vein (to be described in detail elsewhere); (ii) partial pancreatectomy by removal of approximately 40 percent of the pancreas from the caudal region, leaving the remaining tissue and the exocrine ducts intact; (iii) ligation of the portal vein between pancreas and liver; and (iv) an open-and-close sham operation. For surgery, the eels were anesthetized with Finquel (tricaine methonesulfonate). The wounds were closed with continuous nylon sutures. Beads were attached to the base of the dorsal fin to tag the animals. There was no postoperative mortality if the animals survived anesthesia and surgery for 12 hours, except for a few cases where sutures broke open. Unanesthetized animals were killed by decapitation immediately after removal from their containers, and uncontaminated blood, spurting from the ventral aorta, was collected in centrifuge tubes. Total serum cholesterol was determined colorimetrically with the Boehringer Mannheim test kit; serum "sugar" and serum glucose were determined enzymatically with the pertinent Boehringer Mannheim test kits (glucose oxidase and hexokinase methods, respectively). All total pancreatectomies were checked for pancreatic remnants after the animals were killed. All livers were checked macroscopically, histologically, and histochemically [Rossman's fixation at 4°C followed by aldehyde fuchsin with counterstains (*9*), or by Schiff's method for glycogen]; only two animals showed pathological liver alterations (partial necrosis), and these were excluded.

In all groups except the summer animals the values were obtained with the hexokinase method (Fig. 2). Both totally and partially pancreatectomized eels showed an initial hyperglycemia of approximately 350 and 180 percent, respectively, 1 day after the operation. By 3 days after, these groups had returned to the range of controls and