equivalent volume of saline. Details of the effective fractions are reserved for later publication.

All fractions so far tested contain the melanophore-contracting hormone and pallor begins to develop 5–10 min. after injection. Shortly thereafter with certain fractions, on the average in 17 min., the fish become excited and begin to exhibit violent S-shaped spasms. Each spasm lasts from a few seconds to a minute or more. The fins are in rapid vibration or, more rarely, the fish becomes temporarily 'frozen' in a state of extreme flexure. A peak of activity is reached in about 30 min., after which there is a slow decline; but in the most potent fractions occasional spasms may be observed for as long as $1\frac{1}{2}$–2 hr. The direction of flexure is either to the right or left with approximately equal frequency. The fish show no interest in each other but behave independently. Although the response is, in this respect, abnormal, there can be no doubt that the spasms are typical of the spawning behaviour of this species as described by Newman[1].

One completely hypophysectomized fish was injected thrice weekly for four weeks. At autopsy, nuptial colours were lacking and the testes were in total regression. Evidently the hormone responsible for the spawning reflex is not associated with stimulation of the regressed gonads. Nor can the spawning reflex be elicited by injections of methyl testosterone into hypophysectomized males.

Further experiments were made with pairs of unoperated fish, mostly well in advance of normal spawning. The response is exactly the same as in hypophysectomized fish and was elicited equally well in either sex. With the exception of one pair which were close to normal spawning, the development of spasms was not accompanied by emission of eggs or sperm, even after a second or third injection. Young fish, taken in their first spring, were as responsive as those with previous spawning experience.

In an attempt to identify the fraction responsible for the reflex, both normal and hypophysectomized fish were injected with a highly purified prolactin preparation. No response was elicited. Normal fish of both sexes were also injected with purified mammalian follicle-stimulating and luteinizing hormone (Armour and Co.). The follicle-stimulating hormone was inactive; but five out of six fish receiving the luteinizing hormone responded with characteristic spasms. The response appeared more slowly than with fish pituitary preparations, in 42–63 min., and it was less frequent. The luteinizing hormone was tested on a completely hypophysectomized fish and the response developed belatedly, in 77 min.

It is well known that injections of fish pituitary induce spawning in fish well in advance of the breeding season. Gerbilsky[2], an advocate of the neurocrine theory of the spawning hormone, has used intracranial injections for more rapid and effective results; in *Acipenser* the injected fish behaved in a tempestuous manner, leaping out of the water and often injuring themselves. Noble and his associates[3] induced brooding behaviour in the jewel fish, *Hemichromis*, with various pituitary preparations and also with injections of phenol; previous spawning experience was shown to be necessary, but the response could then be elicited even after castration, and it was further demonstrated that the nervous centres associated with the response were located in the corpus striatum. The findings reported in the present communication appear to confirm the theory that the spawning hormone of fish may stimulate sexual behaviour by a direct action on the nervous system. Furthermore, this hormone is apparently related to mammalian luteinizing hormone, which induces a similar response.

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The 'Double Bang' of Supersonic Aircraft

Two explosive sounds in succession have sometimes been heard when aircraft in the vicinity exceeded the speed of sound. As I am not aware of any discussion of this phenomenon, I wish to direct attention to its explanation.

The condition for a shock to reach the stationary observer (in stationary air) can be stated simply with the aid of Huygens's wavelets: it occurs when the wavelets emanating from successive elements of the path of the source (the aircraft) superpose at the observer. This will happen when $-dr/dt = c$, where r is the (scalar) distance between aircraft and observer, and c is the speed of sound. Whatever the speed of the aircraft, no bang is heard by an observer with respect to whom $-dr/dt$ never exceeds the speed of sound. If it does exceed it, then there must be the point on the track where $-dr/dt$ first became equal to c; and, as a high speed of approach cannot be maintained indefinitely (at most until $r = 0$), there must be another point where $-dr/dt$ becomes again equal to c. Each of these two points is the origin of a bang for the particular observer, who would measure the direction and time accordingly.

The bang which is heard first is the one which was generated second, and it is expected to be usually the louder, having the closer origin. The second one to be heard may have its origin far away and hence be faint; but only if the aircraft has been flying nearly directly towards the observer for a long distance, or has been exceeding the speed of sound by a large margin. The most likely case at present appears to be a pair of similar bangs in quick succession.

The part of space in which the bangs can be heard is defined by a surface opening out in the forward direction from the point on the track where the aircraft first reached the speed of sound. An observer on this very surface would hear the two bangs merged into one.

The engine noise arrives at the observer in a complicated way: *before* the first and *after* the second bang, the noise is heard singly and in the time sequence of its generation; between the two bangs, there are three components of noise, one of which is reversed in time.

Note added on October 16. My attention has now been directed to a popular article in *Flight* of October 3 on this subject. That article contains no mention of the essential significance of the 'velocity of approach towards the observer' as distinct from the airspeed, and hence does not contain the main argument presented here.

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Cambridge. Oct. 5.