transcripts (Davidson)[8]. Curiously, a major portion of the egg cytoplasmic poly(A)-containing RNA in sea urchins and in *Xenopus* contains interspersed repeat sequences in relatively long transcripts reminiscent of nuclear RNA (Davidson, Dawid)[9]. They could result from a failure of termination, as seems to be the case in the unusually long transcription units characteristic of lampbrush chromosomes (J. Gall, Yale University)[10], or perhaps from lack of intron splicing (Davidson). The role of these molecules, if any, remains speculative. It is unlikely that they are translated without further processing since many of the repeated elements contain multiple stop codons (Davidson); hence, it is possible a type of developmental control could reside in tissue- and stage-specific completion of RNA processing.

Genetic transcriptional control elements are known to exist upstream from the TATA box in cases such as dimethyl sulphoxide induction of β-globin (Maniatis, Harvard University) and heavy-metal induction of metallothionein (Palmiter) and sometimes quite far upstream[11,12], but their developmental role is equivocal. Other possible developmental controls include tissue-specific differential splicing of primary transcripts as may occur in the *Drosophila bithorax* system (M. Goldsmith-Clermont, Stanford University), tissue- and stage-specific differential gene amplification as evidenced in the *Drosophila* chorion system (F. Kafatos, Harvard University) and tissue-specific differences in protein kinase levels (R. Erikson, Harvard University). So far, cascades of sigma factors seem limited to prokaryotic and viral developmental systems (J. Pero, Harvard University).

Importantly, in a number of cases control is not simply an 'on–off' affair, but rather quantitative changes may be critical. For example, P. Cherbas (Harvard University) reported the early protein level response to ecdysone in *Drosophila* K_c cells involves an increase in the amounts of three proteins (EIP 28, EIP 29 and EIP 40) already present before induction. The main effect of Rous sarcoma virus *src* gene may be to increase the level of cellular protein kinase by 20-fold in order to cause a gross change in cellular morphology (Erikson). The pattern of gene expression can also be affected by the changing location of transposable genetic elements, as documented in maize (B. Burr, Brookhaven National Laboratory)[13], *Drosophila* (Ruben) and yeast (I. Herskowitz, University of California, San Francisco)[14]. It remains to be seen what part such genomic instabilities routinely play in developmental processes outside the vertebrate immune system.

Appropriately, Kafatos cautioned that developmental biologists should not assume that the way things are controlled in one system will be the way they are controlled in another. For example, compare two insects: the silk moth and *Drosophila*. The former constructs its eggshell using germ-line repeated gene pairs while the latter employs differential gene amplification of single-copy genes. Yet, perhaps one should not be too surprised by the difference since the lepidoptera and diptera diverged evolutionarily almost 300 million years ago, about the same time that human and reptilian lines split.

The conference ended with an appealing model from H. Weintraub (Hutchinson Cancer Research Center) concerning activation of chromatin structure[15]. He pointed out that concomitant with the activation of globin genes during chick erythropoiesis, DNase-hypersensitive regions appear at the 5′ ends of the genes due to the formation of single-stranded stem–loop structures. Once induced these hypersensitive sites remain even after removal of the inducer and even through DNA replication. Interestingly, these sites can be induced by salt shock. Changing the salt concentration drastically alters the places where S_1 nuclease will cut. Hence, Weintraub speculates, if the early embryo contains a salt gradient perhaps this could activate different chromatin regions in cells occupying different positions within the gradient. In short, Weismann's determinants could be differential salt concentrations! □

1. Gordon, J.W. & Ruddle, F.H. *Science* **214**, 1244 (1981).
2. McKnight, S.L. & Kingsbury, R. *Science* **217**, 316 (1982).
3. Wagner, E.F., Stewart, T.A. & Mintz, B. *Proc. natn. Acad. Sci. U.S.A.* **78**, 5016 (1981).
4. Palmiter, R.D., Chen, H.Y. & Brinster, R.L. *Cell* **29**, 701 (1982).
5. Darnell, J.E. *Nature* **297**, 365 (1982).
6. Brown, D.D. *Science* **211**, 667 (1981).
7. Flytzanis, C.N., Brandhorst, B.P., Britten, R.J. & Davidson, E.H. *Devl Biol.* **91**, 27 (1982).
8. Davidson, E.H., Hough-Evans, B.R. & Britten, R.J. *Science* **217**, 17 (1982).
9. Davidson, E.H. & Posakony, J.W. *Nature* **297**, 633 (1982).
10. Diaz, M.O., Barsacchi-Pilone, G., Nahon, K.A. & Gall, J.G. *Cell* **24**, 649 (1981).
11. Shermoen, A.W. & Bechendorf, S.K. *Cell* **29**, 601 (1982).
12. Muskavitch, M.A.T. & Hogness, D.S. *Cell* **29**, 1041 (1982).
13. Burr, B. & Burr, F.A. *Cell* **29**, 977 (1982).
14. Herskowitz, I. & Oshima, Y. in *Molecular Biology of Yeast Saccharomyces: Life Cycle & Inheritance,* 181 (Cold Spring Harbor Laboratory, New York, 1981).
15. Larsen, A. & Weintraub, H. *Cell* **29**, 609 (1982).

100 years ago

ELECTRIC NAVIGATION

THE idea of propelling a boat through water by the motive power of electricity is no new one. The invention of the electromagnet showed the power of an electric current to produce a mechanical force. It was no very difficult matter, therefore, for the electricians of fifty years ago to utilise the force of the electromagnet to drive small electromagnetic engines; and from the small beginnings of Dal Negro, Henry, Ritchie, and Page, grew up a group of electric motors which only awaited a cheap production of electric currents to become valuable labour-saving appliances. Nor was it a very long stride to foresee that if a sufficiently powerful battery could be accommodated on board a boat, it might be possible to propel a vessel with electromagnetic engines drawing their supply of currents from the batteries. This suggestion — one of the earliest, indeed, of the many applications of the electromagnet — was made by Prof. Jacobi of St. Petersburg, who, in 1838, constructed an electric boat. This machine was worked at first by a Daniell's battery of 320 couples, containing plates of zinc and copper, 36 square inches each, and excited by a charge of sulphuric acid and sulphate of copper. The speed attained with this battery did not reach so much as 1¼ miles per hour. But in the following year, 1839, the improvement was made of substituting 64 Grove's cells, in each of which the platinum plates were 36 square inches in area. The boat, which was about 28 feet long, 7½ broad, and not quite 3 feet in depth, was propelled, with a convoy of fourteen persons, along the River Neva, at a speed of 2¼ (English) miles per hour.

The electric launch *Electricity,* which made its trial trip on Thursday, September 28, 1882, on the waters of the Thames, is certainly a great advance upon that which had been previously attained. This boat, is of iron, and is a trifle less in length than the wooden boat which Jacobi propelled. She will carry twelve persons, though at the trial trip but four were on board. After a few minutes' run down the river and a trial of the powers of the boat, to go forward, slacken, or go astern at will, her head was turned Citywards, and she sped — I cannot say steamed — along the southern shore, running about eight knots an hour against the tide.

From *Nature* **26**, 554, 5 October 1882.

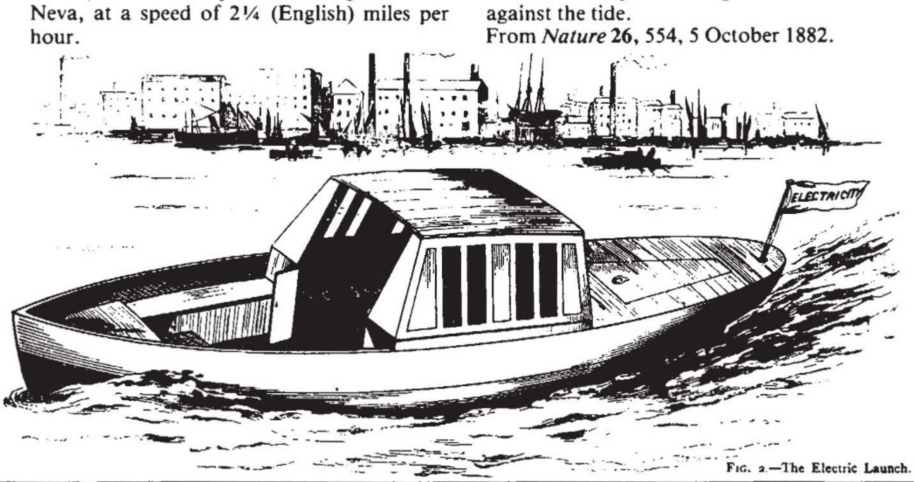

FIG. 2.—The Electric Launch.

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