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Book Reviews

Translational Control. Edited by J. W. B. HERSHEY, M. B. MATHEWS and N. SONENBERG. Cold Spring Harbor Laboratory Press, 1996. 794 pages. Price $95 cloth. ISBN 0 87969 458 0.

There is still a tendency for geneticists to think that regulation of gene expression is to do with control of transcription and nothing much else. This Cold Spring Harbor monograph provides a welcome corrective, making clear the broad range of mechanisms that exist for control at the translational level. It combines molecular detail with the intention to articulate general features and to make clear what questions remain unresolved. This is manifest in the opening chapter by the editors, which covers the history of the field and also provides an overview by listing the possible targets for translational control together with mechanisms found to involve them. The next chapter reviews the pathway and mechanism of eukaryotic protein synthesis (Merrick and Hershey), after which the specialised chapters begin. mRNA can be a target through upstream primary structure features such as the 5′ cap, sequences ('context') flanking the initiator AUG, and the presence of upstream AUG's (Merrick and Hershey; Jackson) or upstream open reading frames (uORF's: Geballe; Hinnebusch). *Cis*-acting elements may also occur throughout the mRNA, e.g. the iron-responsive element (IRE) found in the 5′ untranslated region (UTR) of ferritin and other mRNA's (Rouault, Klausner and Harford). An instance of involvement of the 3′ UTR in control, in *C. elegans*, is given in another overview chapter, on translational control decisions in development (Wickens, Kimble and Strickland). The role of the poly(A) tail is discussed by Jacobson, who puts forward the 'closed-loop' model whereby this acts together with the 5′ cap structure, and by Richter. mRNA degradation comes into Jacobson's story also, as well as being discussed in the context of its coupling to translation, by Theodorakis and Cleveland.

The role of initiation factors in translational control is relatively well known, since it can involve high profile properties such as phosphorylation (though other forms of control are described here: cleavage, or binding of other proteins). For eIF3, 4B, 4F and 4G, phosphorylation leading to enhanced translational ability is modulatable by viral infection, heat shock, or the response to growth factors or hormones (Mathews; Schneider; Duncan; Sonenberg). The phosphorylation of eIF2, which inhibits the exchange of GDP for GTP and thus its ability to recycle (Trachsel), is involved in similar responses, and also serum deprivation (Clemens; Katze), while an eIF2 kinase in yeast, GCN2, mediates response to amino acid deprivation (Hinnebusch). Changes in elongation rates involving phosphorylation of eEF2 in response to e.g. growth-promoting stimuli or calcium ion fluxes are discussed by Nairn and Palfrey. Phosphorylation of ribosomal proteins can link growth-promoting stimuli, via signal transduction pathways, to the phosphorylation of ribosomal protein S6 (Jeffries and Thomas; Meyuhas, Avni and Shama). The chapter by Spirin, on masking of translatable mRNA within ribonucleoprotein particles, is particularly apposite since it is just 30 years since he himself proposed this idea.

There are several chapters devoted to translational control strategies in virus-infected cells, deployed both by the viral invader and the defending host. A general overview of the interactions involved is given by Mathews. There follow accounts of the internal ribosome entry site (IRES) present in the RNA of picornaviruses, which prevent function of the 5′ cap of cellular mRNA's (Ehrenfeld), adenovirus and vaccinia (Schneider), and influenza and reovirus (Katze). Finally, there are chapters on mRNA's that contain elements signalling ribosome frameshifting, hopping, termination codon readthrough, or selenocysteine incorporation (Atkins and Gesteland); mammalian ribosomal proteins (Wool, Chan and Glück); mitochondrial translation (Fox); and the sole chapter exclusively devoted to prokaryotic systems (Voorma), although illuminating comparisons with prokaryotes occur throughout.

The nature of the book makes it unlikely that many individuals will buy it, but laboratories in related fields will find it essential, and it should be in the libraries of universities, institutes and firms active in molecular and cell biology. Much of the material is accessible to final year undergraduates and post-graduates. And – though not involved in the field myself – I found it extremely interesting.

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