et al. 1970). The spectral linewidth, which is of the order of 100 Hz (about 10^{-9} Å), arises from the thermal motion of the macromolecules. Translational diffusion, which makes the major contribution, leads to a random variation in phase of the scattered light, and this corresponds to a Lorentzian distribution about the incident light-frequency of half-width $(16\pi^2/\lambda^2) \cdot D \cdot \sin^2\theta/2$, where D is the translational diffusion constant, λ the wavelength and θ the angle of scatter. In addition, broadening may result from random variations in particle scattering factor as a result of rotation or changes of configuration, or of rotational variation of polarizability with optically anisotropic molecules (Pecora, 1970, and references cited therein).

Investigation of such small frequency shifts is impossible by conventional optical techniques, and the optical homodyne, made possible by the long coherence length available from a laser, is the most common technique used. In this case the quantity actually measured is (Sellen, 1970):

$$\overline{s_B^2} = 2c^2 \cdot \gamma^2 \cdot \Delta B \int_0^\infty I_{B/2-\Omega} \cdot I_{B/2+\Omega} d\Omega$$

where s_B is the reading obtained from a wave analyser at frequency B , $c^2 \cdot \gamma^2 \cdot \Delta B$ is a constant associated with the optical and electrical parameters, and I the intensity distribution function of the scattered light. In the simple case of translational diffusion $\overline{s_B^2}$ is a Lorentzian distribution of beat frequencies of twice the spectral width. However, for reasons given by information theory, it is preferable to use a correlation-function computer rather than a wave analyser. This yields the Fourier transform of the beat signal, which is the same as the square of the Fourier transform of I , and is given by $e^{-2K^2 D \tau}$ where $K = (4\pi/\lambda) \cdot \sin\theta/2$ and τ is the correlation-function delay time.

An apparatus suitable for work of this kind has been set up in this laboratory. Some preliminary results for G-actin are presented, and the particular difficulties involved with this material are discussed.

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Uptake of Calcium Ions and the β -Adrenergic Receptor Site in Cardiac Muscle

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The generation of systole and diastole in the heart presents an alternative system to skeletal muscle in the study of excitation-contraction coupling (Gillibrand, 1970). As in skeletal muscle, transport of Ca^{2+} relative to membranes is closely involved with myocardial contractility (Nayler, 1967), and Ca^{2+} flux is regulated by the sarcoplasmic reticulum (Porter & Franzini-Armstrong, 1965). In the heart both contractility and rate are augmented by noradrenaline, through the β -adrenergic receptor site. This consists minimally of a structurally organized enzyme system, adenylate cyclase and phosphodiesterase, which are known to be membrane-bound (Robison, Butcher & Sutherland, 1970). Rasmussen & Tenenhouse (1968) have proposed theoretically that Ca^{2+} transport can be linked to cyclic AMP (adenosine 3':5'-cyclic monophosphate), but the mechanism of coupling requires further investigation.

In order to demonstrate enzymic activity associated with Ca^{2+} uptake, preparations of fresh fragmented sarcoplasmic reticulum in 5 mM-dithiothreitol (Van der Kloot, 1969) were obtained by using the method of Gertz, Hess, Lain & Briggs (1967). The presence of theophylline, which inhibits the specific phosphodiesterase breaking down cyclic AMP (Butcher & Sutherland, 1962), gave a much higher Ca^{2+} uptake than in the control. Both noradrenaline and cyclic AMP also increased Ca^{2+} uptake significantly. Ouabain, which stimulates myocardial contractility in the failing heart, gave a lower value, but this was significantly above the control value. Both propranolol, a specific β -receptor-blocking drug, and practolol, which has some sympathomimetic activity, significantly decreased the Ca^{2+} uptake relative to control. Nicotine, an inhibitor of adenylate cyclase, gave the largest decrease.

By using the method of Krishna, Weiss & Brodie (1968), it was found that these membrane preparations had a high specific adenylate cyclase activity. Addition of noradrenaline significantly increased the total amount of cyclic AMP formed.

Alteration of Ca^{2+} uptake by drugs known to affect adenylate cyclase and phosphodiesterase activities indicates that the energy for Ca^{2+} uptake by cardiac microtubules may be regulated by membrane-bound adenylate cyclase. The data for cyclic AMP are consistent with the view that this nucleotide could form part of the carrier system

for the active transport of Ca^{2+} across the membrane. The noradrenaline stimulation of both Ca^{2+} uptake and adenylate cyclase activity in preparations of cardiac sarcoplasmic reticulum suggests an energy relation between Ca^{2+} transported and cyclic AMP synthesized.

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Structural and Functional Changes of Isolated Rat Diaphragm after Treatment with Caffeine together with Local Anaesthetics and β -Receptor Blockers

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Caffeine (5mM) enhances the endogenous respiration rate of isolated rat diaphragm and inhibits the incorporation rate of amino acids into protein. This inhibition is not prevented by the local anaesthetics butacaine, cinchocaine and amethocaine (1mM), although these substances decrease the caffeine-induced enhancement of respiration. Local anaesthetics on their own do not lower the respiration rate, but enhance it considerably (Manchester, 1970). The β -receptor blockers D- and L-propranolol, alprenolol, oxprenolol and to a smaller extent practolol exhibit effects similar to those of the local anaesthetics.

PTAH staining demonstrated various degrees of fibre disruption and Z-band alterations with some of the compounds. When the tissue was examined under the electron microscope, it could be seen that the mitochondria showed specific responses to the different drugs used. After incubation of the tissue in caffeine most of the mitochondria were character-

ized by a non-condensed matrix and an increased number of angulations per unit cristal length, the cristae often running in a circular manner. After treatment with the local anaesthetics alone the matrices became very condensed with either very straight cristae giving a rope-like appearance or else the cristae were markedly angulated and frequently in phase with the next crista. Incubation with the two together gave a structure indistinguishable from the control, which could be related to the effect on caffeine-enhanced respiration. Three of the β -receptor blockers (L- and D-propranolol and alprenolol) gave a similar change in structure compared with that of the local anaesthetics; however, instead of reversing the caffeine effect, the tissue was further disrupted. This suggests that the apparent reversal of the caffeine-enhanced respiration by these drugs was caused by a deterioration of the tissue, resulting in decreased Q_{O_2} . Oxprenol and practolol alone produced little or no change, and oxprenolol appeared to modify the caffeine effect.

Where fibres were badly disrupted, some mitochondria showed a non-specific drug response. This was characterized by an electron-dense intracristal material in these structures, formerly only seen in isolated organelles (Vogell, 1962; Bullock, Carter & White, 1970). These were surrounded by a cytoplasm lacking its normal density, and their matrices were also clear. Valinomycin ($1\mu\text{M}$) was able to emulate the non-specific drug effect and at $0.1\mu\text{M}$ produced the local-anaesthetic-like response.

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A Study of the Relationship between Glucocorticoid-Induced Weight Loss in Rats and the Activity of Skeletal-Muscle and Cardiac-Muscle Ribosomes *in vitro*

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Five glucocorticoids, when administered daily to rats for 5-7 days at a dosage of 5mg/kg body wt., were shown to lie in the following order of catabolic potency: corticosterone < prednisolone < triamcinolone < betamethasone < dexamethasone < triamcinolone acetate. Catabolism was measured on the basis of daily body-weight change and the change in weight of a group of white muscles (vastus medialis, vastus lateralis and gluteus medius).

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