

ACTIVE STRETCH-SHORTEN CONTRACTIONS OF THE
M. PECTORALIS IN THE EUROPEAN STARLING (*STURNUS
VULGARIS*): EVIDENCE FROM ELECTROMYOGRAPHY
AND CONTRACTILE PROPERTIES

by

G. E. GOSLOW, Jr.¹ and K. P. DIAL²

(Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ 86011, U.S.A.)
(Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138, U.S.A.)

ABSTRACT

An analysis of the contractile properties of the muscles that control the wing is requisite to an understanding of the mechanics and neural control of bird flight. It has been demonstrated that for starlings in flight, electrical activity (EMG) of the M. pectoralis begins during the upstroke prior to the beginning of downstroke (DIAL *et al.*, 1987). In the present study, the isometric contractile properties of the sternobrachialis (SB) head of the M. pectoralis in European starlings (*Sturnus vulgaris*) were measured. Electromechanical delays of 3-5 ms from EMG onset to force in isolated muscle suggest that the SB is actively stretched at the end of the upstroke; a finding with implications for the cost of flight. Average twitch contraction and relaxation times and times of force rise and fall during maximum tetanus do not possess a simple relationship to wingbeat frequency. Additional parameters of muscle are suggested for study.

KEY WORDS: Contractile properties, M. pectoralis, flight.

INTRODUCTION

It is clear that among terrestrial vertebrates the storage of elastic strain energy in tendons, muscles, and bones may not only facilitate locomotor movements in a variety of ways, but may also reduce the costs of locomotion (ALEXANDER, this volume). Related to this issue are studies which reveal that a muscle can absorb mechanical energy when actively stretched and that its work output increases when active shortening is preceded by a period of active lengthening (CAVAGNA *et al.*, 1968). Using the toad sartorius muscle, CAVAGNA *et al.* (1968) illustrated that the positive work normally performed during shorten-

¹ Offprint requests to Dr. G. E. Goslow Jr., present address: Section of Population Biology, Morphology and Genetics, Brown University-Box G-BMC, Providence, RI 02912, U.S.A.

² Present address: Division of Biological Sciences, University of Montana, Missoula, MT 59812.

