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## Introduction

The field of Babylonian astronomy has been transformed over the past three decades, changing from an almost exclusive focus on the mathematical astronomy of the late period (generally known as ‘ACT’ astronomy after the acronym of Otto Neugebauer’s classic *Astronomical Cuneiform Texts* published in 1955) to embracing a much broader consideration of all aspects of the subject, both early and late, mathematical and observational, astronomical and astrological, and their relationships between one another. Lis Brack-Bernsen has been a key figure in turning the study of Babylonian astronomy into what it is today.

Among Lis’ many contributions to the study of Babylonian astronomy, two have been particularly significant in shaping the way that research in the field has progressed. The first is by drawing attention to the so-called ‘lunar six’ time intervals – measurements of the time between the moon and sun crossing the horizon on six specific occasions during a month – which were regularly observed in Babylon from at least as early as the middle of the seventh century BC. In a series of papers, Lis has explored the role of lunar six observations and the development of the ACT lunar systems, the first attempt to answer the question of the relation of observation and theory in Babylonian astronomy, and, even more significantly, uncovered a Babylonian method of using past lunar six observations to predict future lunar six intervals which was completely unknown to modern scholars and whose discovery has opened up a whole new area of research. Almost as important as her own work in these areas has been Lis’s second transformative contribution to the study of Babylonian astronomy: the foundation of the so-called ‘Regensburg’ series workshops on Babylonian astronomy which have brought together specialists for intensive, detailed, and collegial discussion of different aspects of Babylonian astronomy. The first Regensburg workshop, held in Regensburg in 2002, was so successful that it has been followed by ‘Regensburg’ workshops in Amsterdam (2004),

Durham (2008), and Berlin (2014), with discussions already underway for the next in the series. It is no exaggeration to say that these workshops have significantly influenced the direction of research on Babylonian astronomy over the past decade.

In addition to her work on the lunar six, Lis has made significant contributions to many other aspects of the study of Babylonian astronomy including deepening our understanding of the early astronomical compendium MUL.APIN, and research on the gnomon and the origin of the zodiac, the operation of the Babylonian calendar, and the mathematical astrological schemes known as the *Kalendertexte* and *dodecatemoria* schemes. Outside of Babylonian astronomy, she has also published important works on Babylonian mathematics and, earlier in her career, on Mayan astronomy.

The papers in this collection are offered in honor of Lis Brack-Bernsen by her colleagues and friends, including many of the participants in the Regensburg workshops. The topics of the articles are linked by the themes that have been at the center of much of Lis's own work: the Babylonian observational record, and the relationship between observation and theory; the gnomon, sundials, and time measurement; and the relationship between different scientific activities in the ancient world, especially the connections between mathematics and astronomy.

A tradition of regular and precise observation lies at the heart of Babylonian astronomy. One of the most common types of observation recorded by the Babylonian astronomers is of the position of the moon and the planets relative to a group of reference stars. In their paper Gerd Graßhoff and Erich Wenger analyze Babylonian observations of this kind in order to understand the coordinate system underlying these measurements, demonstrating that positions were measured parallel and perpendicular to the ecliptic. The earliest systematic records of Babylonian observations date to the eighth and seventh centuries BC. John Steele discusses one of the earliest records of planetary observations, a compilation of reports of Mars's synodic phenomena dating to the reign of Nebuchadnezzar II. Using Lis Brack-Bernsen's work on the lunar six as a starting point, Teije de Jong discusses the development of Babylonian lunar theories from observations of the lunar six and eclipses. Peter Huber analyzes records of the length of the month and their application to the problem of Old Babylonian chronology. Mathieu Ossendrijver edits and discusses a text which describes methods of predicting planetary conjunctions from past observations, using the same principle of 'goal-year' astronomy as Lis Brack-Bernsen uncovered for the lunar six.

The gnomon and the sundial were used across the ancient world to measure time and to study the daily and yearly motion of the sun. Elisabeth Rinner analyzes the mathematics of conical sundials, one of the most common types of Greco-Roman sundial, and its connection with theories of conic sections. Alexander Jones's paper complements Rinner's by providing an analysis of spherical sundials and the geometry of curves. Also

related to time measurement, Hermann Hunger reedits (with the addition of a substantial new fragment to the tablet) and analyzes a Neo-Assyrian text which has previously been thought to concern seasonal hours, demonstrating that this is not the case.

The relationship between different types of ancient science is explored in the final three papers. Jens Høyrup's paper examines the various forms and places of mathematics and mathematicians in the ancient world. Wayne Horowitz and John Steele examine a peculiar cuneiform tablet which combines numbers with star names. Finally, Francesca Rochberg studies the relationship between astronomy and divination, and in particular the idea of norms and deviations from those norms in Babylonian divinatory traditions.

Together, the papers in this volume present a snapshot of research into the ancient exact sciences. They demonstrate the wide variety of questions asked and approaches used by historians of ancient science, and comprise, as we hope, a fitting tribute to Lis Brack-Bernsen's groundbreaking work in this field.

The editors wish to express their thanks for Alex Schwinger for his assistance in the production of this volume, and the Excellence Cluster Topoi for publishing this volume in the series *Berlin Studies of the Ancient World*. We also remember Norbert A. Roughton, who contributed the foreword to this volume, but sadly passed away before its publication. Roughton had participated in all four of the 'Regensburg' workshops and will be sorely missed at future workshops.