of roots of a polynominal in a half plane. The original method of Routh is given in full detail. A somewhat more useful criterion, developed by Lienard and Chipart, is presented; it involves the calculation of fewer determinants than the original Hurwitz technique.

This book cannot be recommended too highly, for it contains material otherwise unavailable in book form. One could wish that material on infinite matrices were included, but this lack does not detract from the stature of Gantmacher's book as an exposition on finite matrices. The translation is a good one, but there are several misprints which are easily spotted.

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Measurement of Subjective Responses: Quantitative Effects of Drugs. Henry K. Beecher. Oxford University Press, New York, 1959. xvi + 499 pp.

Henry Beecher, well-known research professor of anesthesia at Harvard, has written an important volume, summarizing a vast amount of recently developed information on the subjective responses of various kinds of people to various kinds of drugs. It is interesting that this subject was popular a little more than a century ago; S. F. C. Hahnemann (1755–1843), founder of the medical sect of "homeopathy," systematically tested all kinds of drugs, even in extremely small doses, in order to note their effects on himself. Responses to these tiny doses were largely subjective.

Let me say at once that Beecher's volume is a comprehensive, detailed, systematic, well-written, carefully arranged, and very useful reference work. It is fully documented (1063 references, with full titles and pagination), and it has a helpful index.

The volume is skillfully organized. The first part deals with the measurement of pain: a prototype for the quantitative study of subjective responses. The second part deals with the quantitative study of the effects of drugs on various subjective states.

After an interesting introduction attempting to define pain and its characteristics as a sensation, Beecher goes on to give a systematic critique of methods for measuring pain. An important discussion of placebos and placebo reactors follows. It is astonishing what a large number of subjective responses are obtained from the administration of biologically inert chemicals, such as lactose. This simply confirms Hahnemann.

Beecher goes on to consider statistical problems in double-blind testing, pain thresholds, the effects of analgesic agents on pain thresholds, the important matter of drug interactions, synergism and potentiation, factors producing variation in the pain threshold, and action factors of the pain experience.

Beecher concludes that pain cannot be satisfactorily defined. Pain sensations and pain perceptions are identical, representing an indefinite amount of psychic processing. Pain thresholds are not constant, either with respect to individuals or from time-to-time in a given person. Experimentally induced pain and pain resulting from disease differ in their components, and the techniques of producing experimental pain are not fully satisfactory for appraising analgesic agents. There is no dependable relationship between the number of pain spots stimulated, or the degree of their stimulation, and the extent of pain invoked. Analgesic agents appear to exert their effect on the "reaction component" rather than on the "original sensation."

The second part of the volume begins with a discussion of the measurement of "mental clouding" and other subjective effects of morphine. It proceeds to a consideration of sedation and hypnotic states, and then to a review of the effects of anesthetic agents on subjective states. Psychotomimetic drugs, as well as the general subject of euphoria and dysphoria, are surveyed; and then consideration is given to quantifiable expressions of anxiety, with a review of quantitative studies of the effects of narcotics on hunger. Nausea and pruritis are discussed separately. There is consideration of experimental and pathological cough, with regard to subjective and objective components.

Unfortunately, this second part of the book does not include a summarizing chapter. Perhaps Beecher thought that the intelligent reader would go back over the whole effort and attempt to make his own summary. This would not be easy, because such a vast amount of information is explored so thoroughly and so significantly that it really would be a repetitive effort to try to compile a summary. For these same reasons, it is difficult to review the book except in generalizations.

Beecher's effort is provocative, stimulating, and inspiring: its skillful analysis of the various factors concerned in the complicated concept, "pain," is provocative; its suggestions for logical approaches to pain relief are stimulating; and the way in which it has been compiled, written and published is inspiring. This is really a monumental contribution.

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Zulu Journal. Field notes of a naturalist in South Africa. Raymond B. Cowles. University of California Press, Berkeley, 1959. xiv + 269 pp. Illus. $6.

Each of Raymond Cowles' many fine research papers contains a little extra. Beyond its technical content, each paper brings a smell of the outdoors into modern scientific periodicals, an all-too-rare aroma that comes from a naturalist's broad curiosity about the living animal in its native haunts. *Zulu Journal* is the other side of the coin. In this sensitive, often poetic account of human ecology in Natal Province, Union of South Africa, are intriguing bits of information—adaptations in color matching (including negroid skin and zebra stripes), food webs, and heterothermism. For this reason, the book will give the scientist rewards beyond the pleasure of reading colorful, picture-evoking descriptions of animal and human life on the African veld.

Zulu Journal is not a journal, for it gives no consecutive account of Cowles' field work. Instead, it flits about with the deceiving aimlessness of a butterfly, picking up an anecdote here and there, inspecting an ecological situation briefly, encountering amazing numbers of different animals and sizing up each for its place in the African world. Without effort the reader comes to see through experienced eyes "the mood of the country, its seasons, and the passing years."

In chapter after chapter, Cowles tips his hand to reveal what is coming in the final one. To him it is evident from the rapid changes of the past 50 years in the land of his birth that "Against the deadliest weapons of man, fecundity and agriculture, scarcely anything but weeds or parasites can survive for many more decades." The final chapter, starkly titled "Man," still comes