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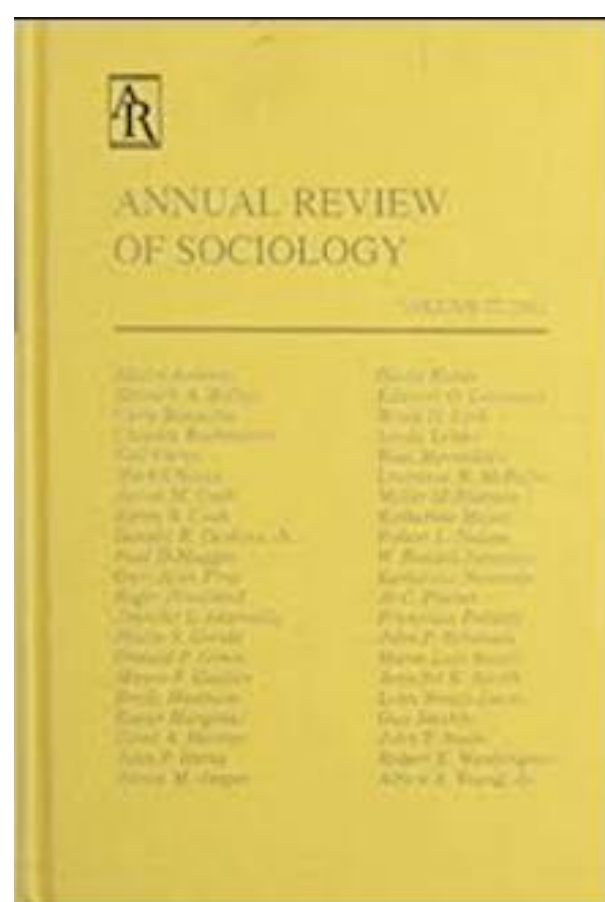
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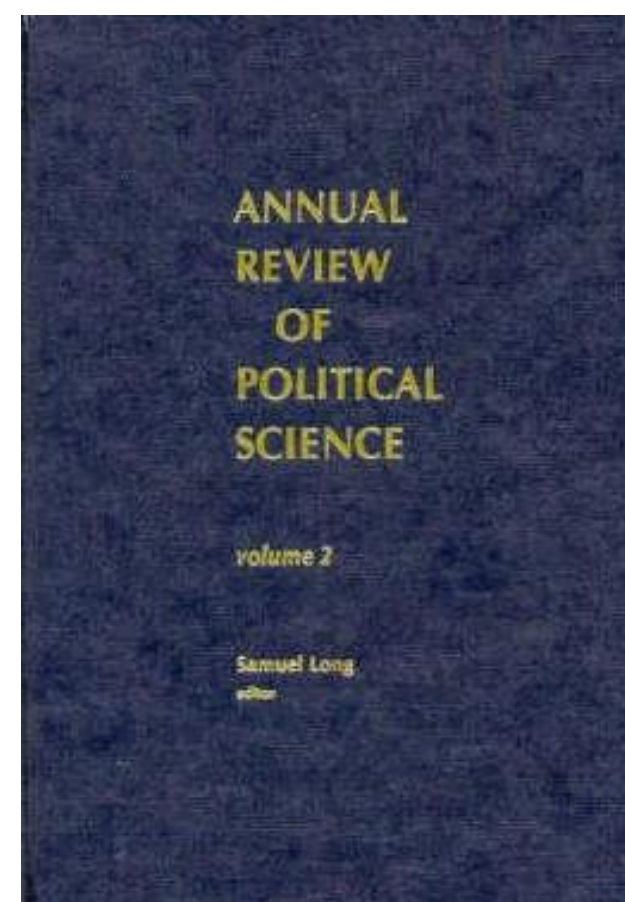
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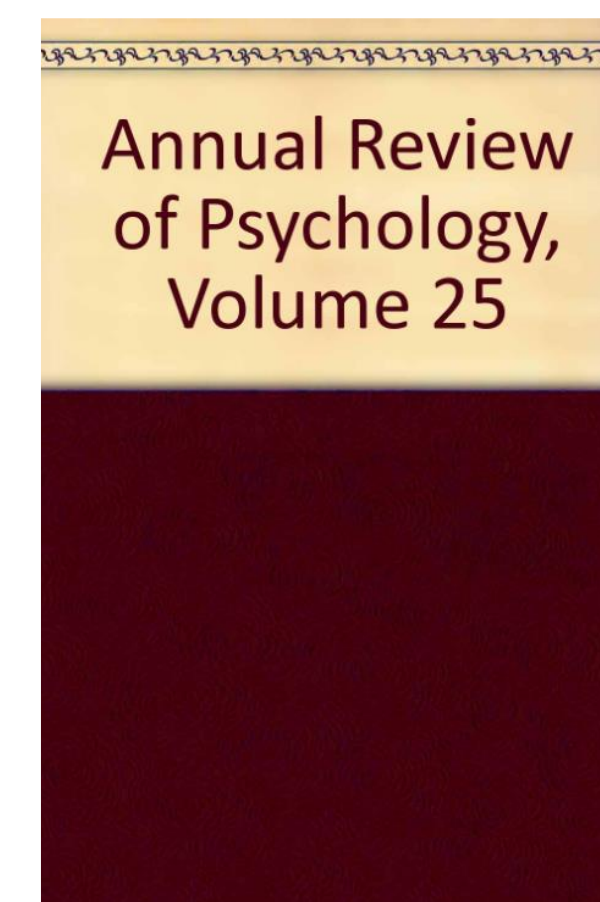
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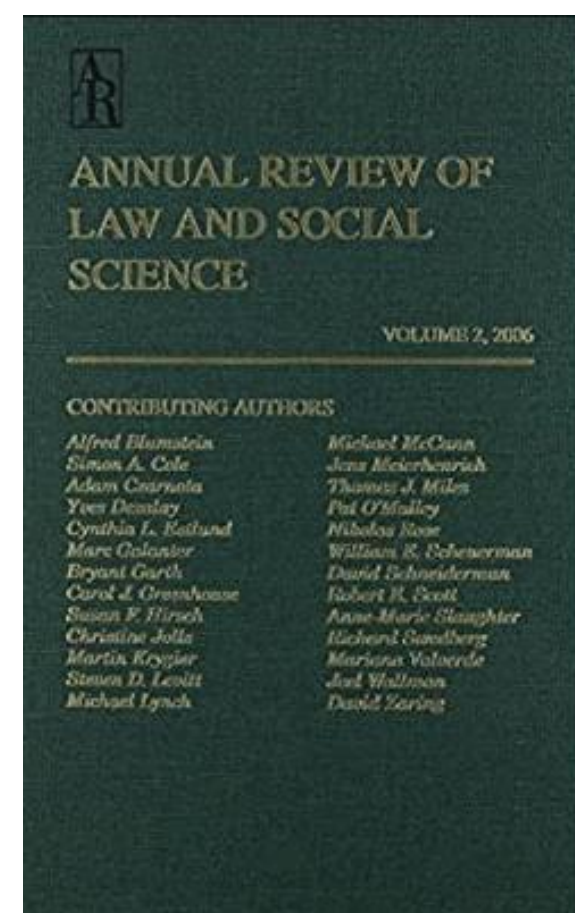
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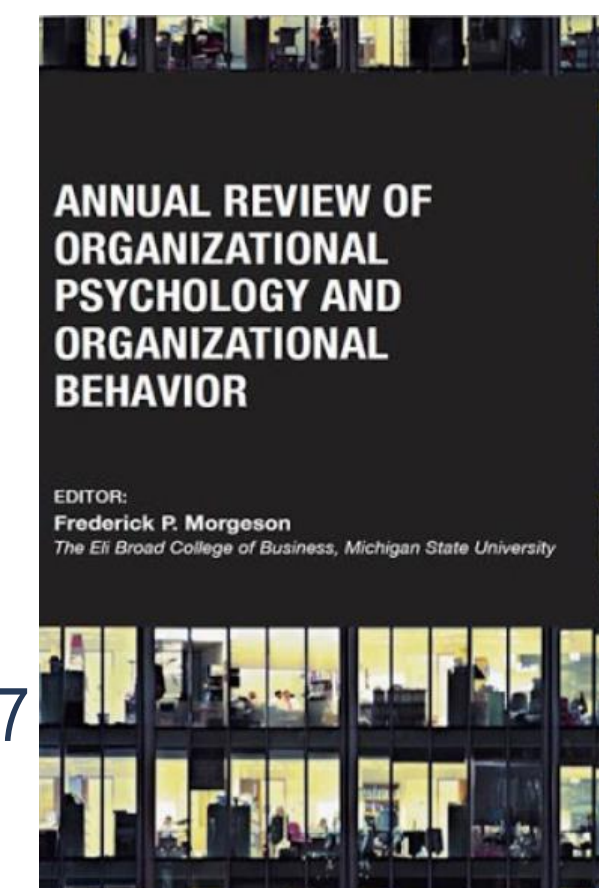
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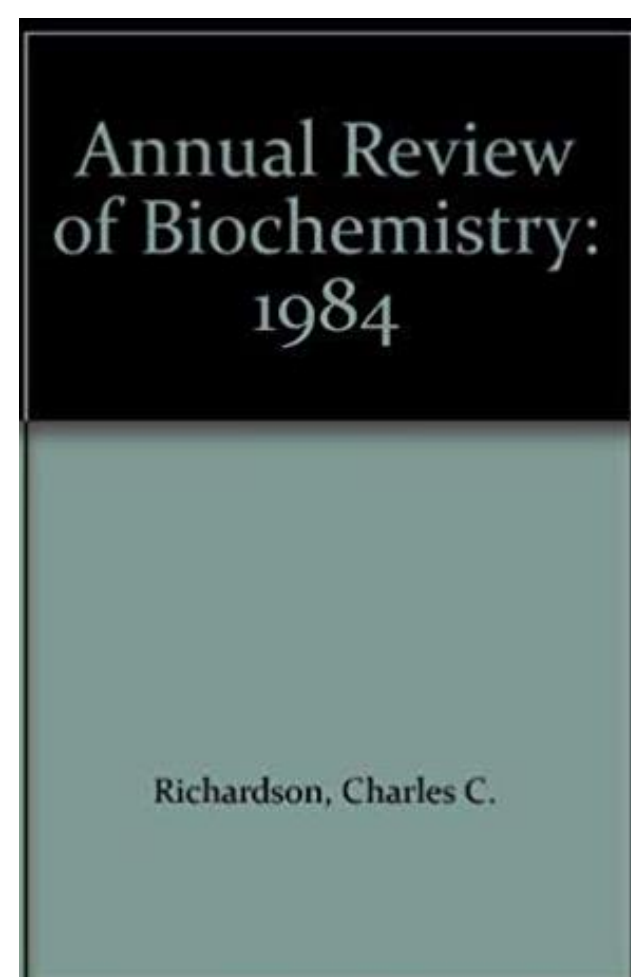
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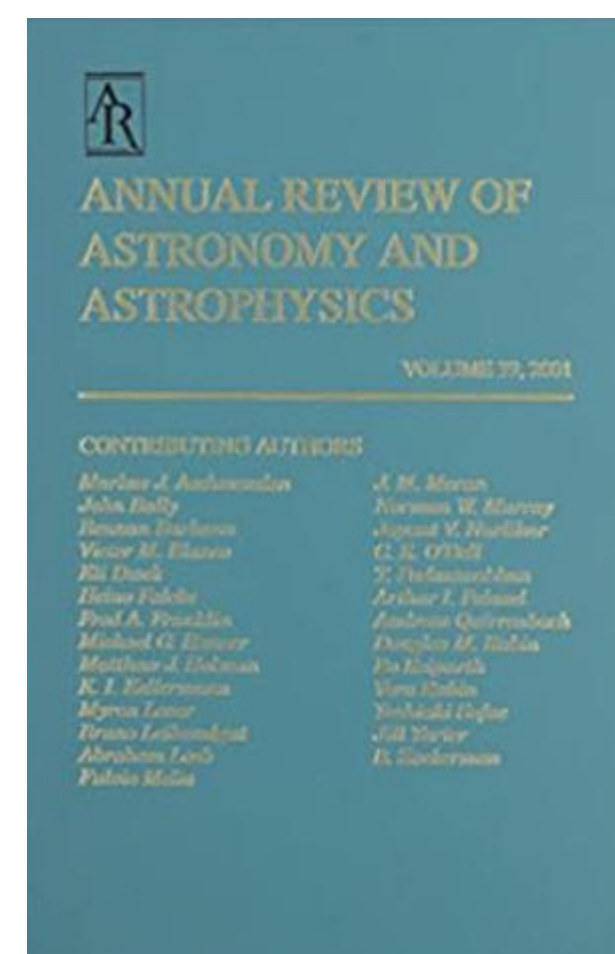
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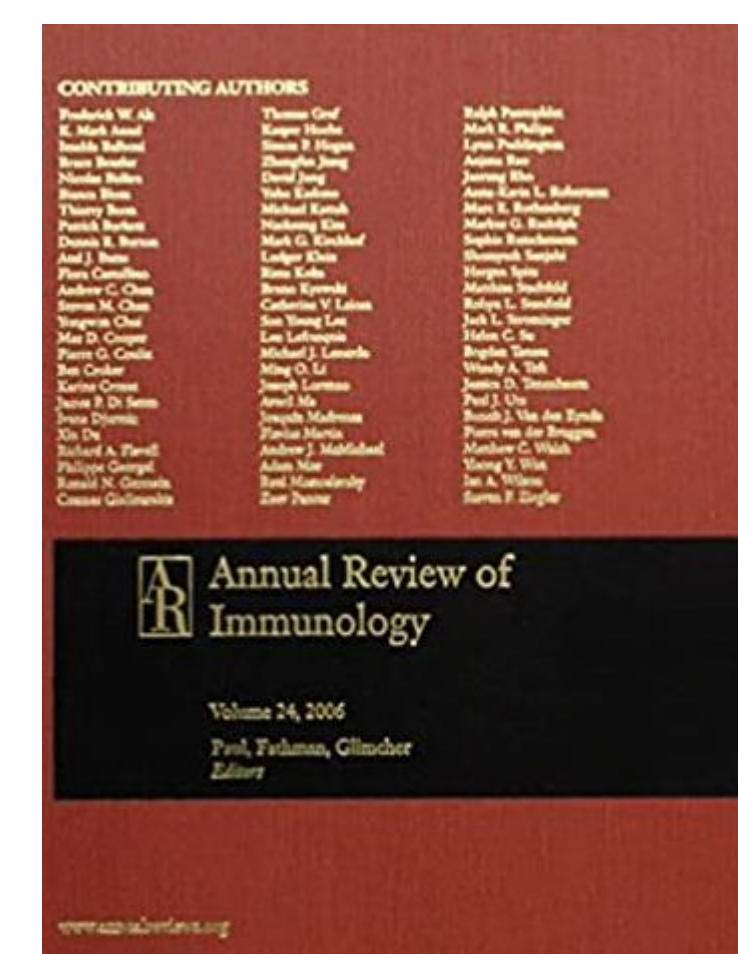
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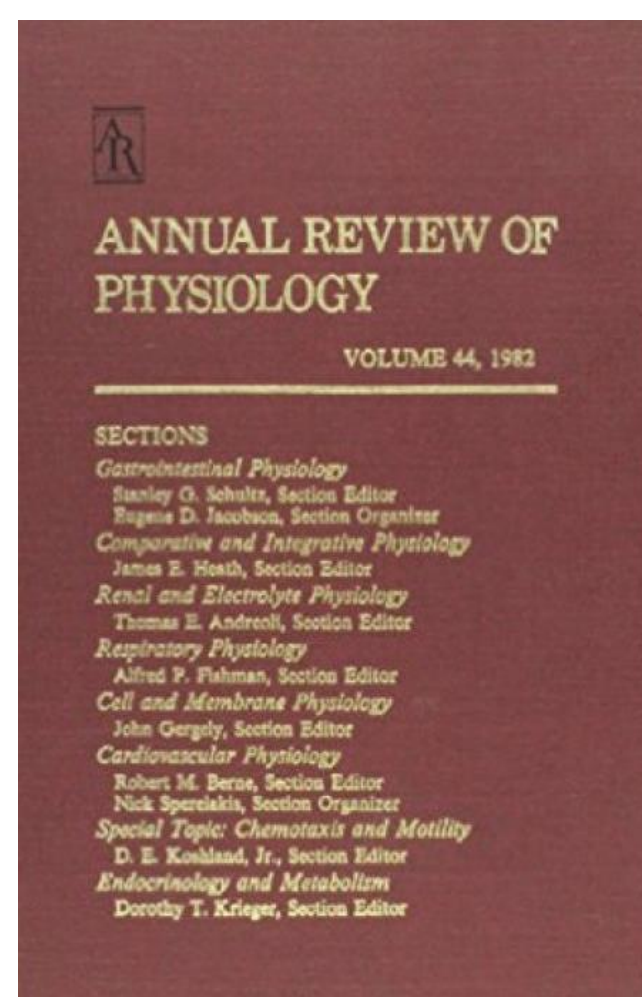
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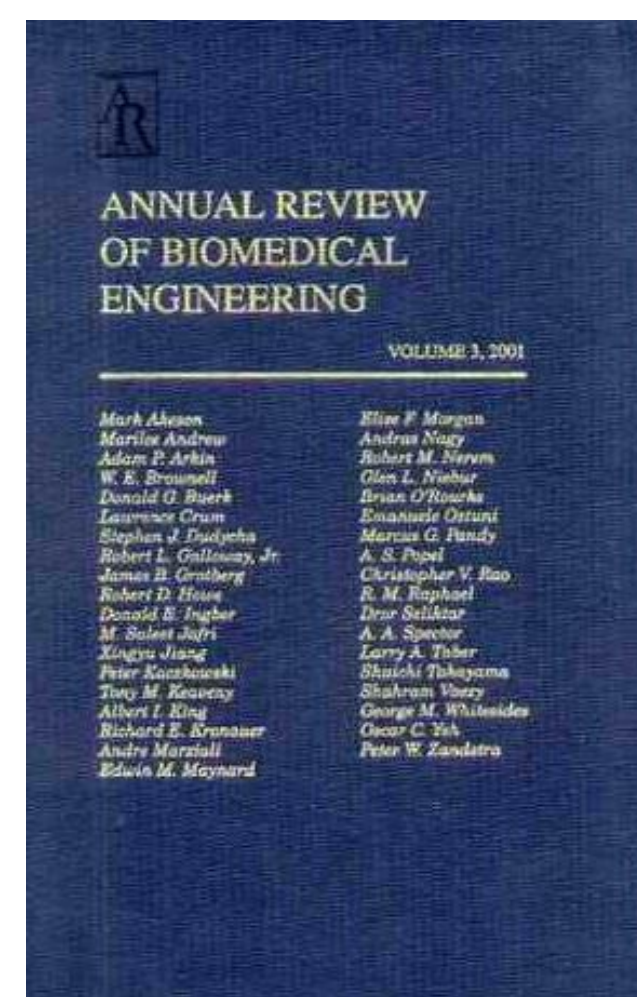
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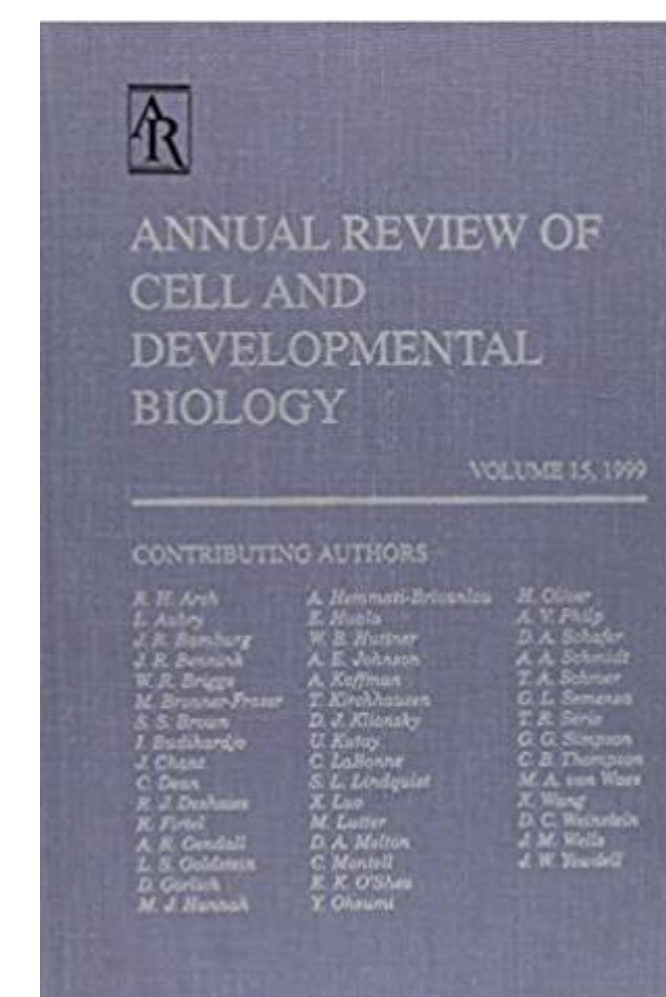
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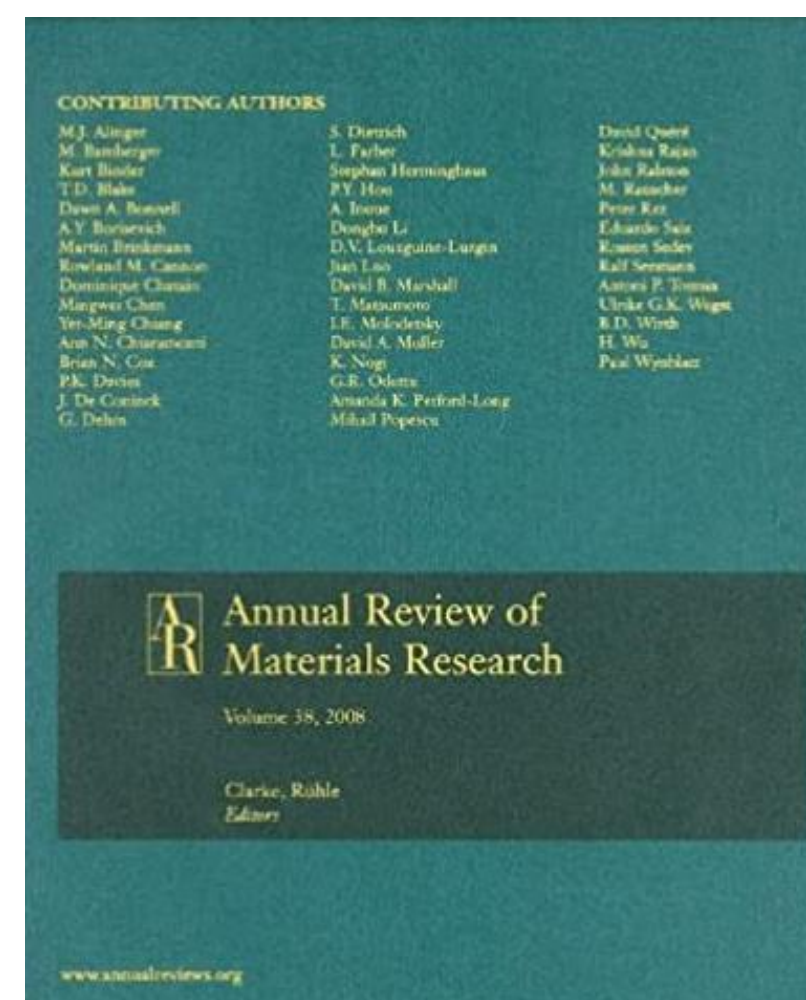
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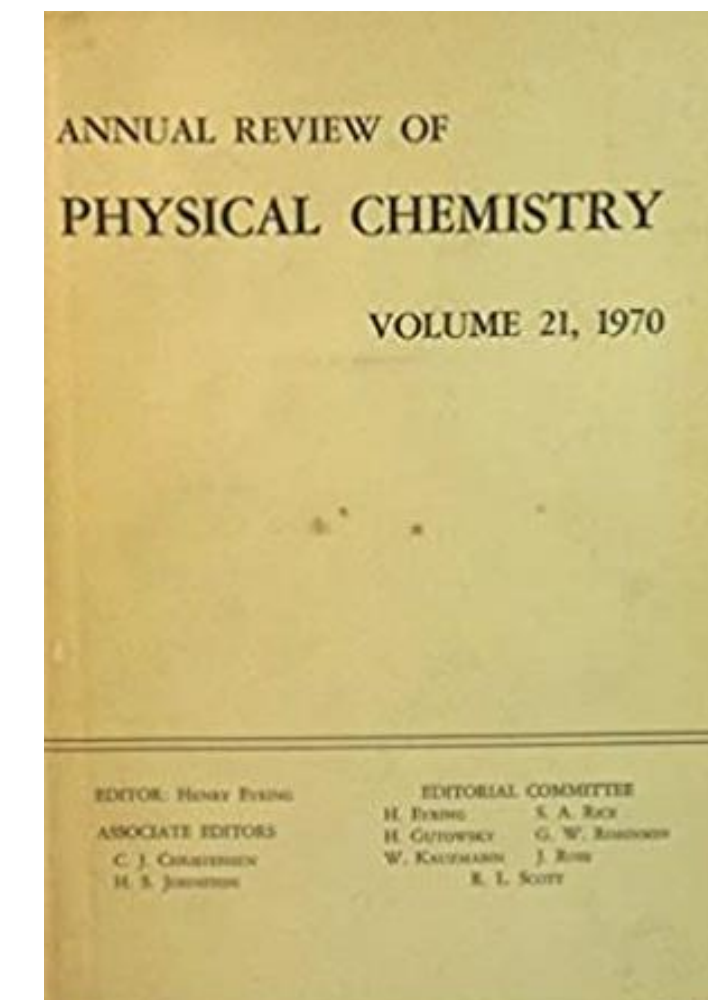
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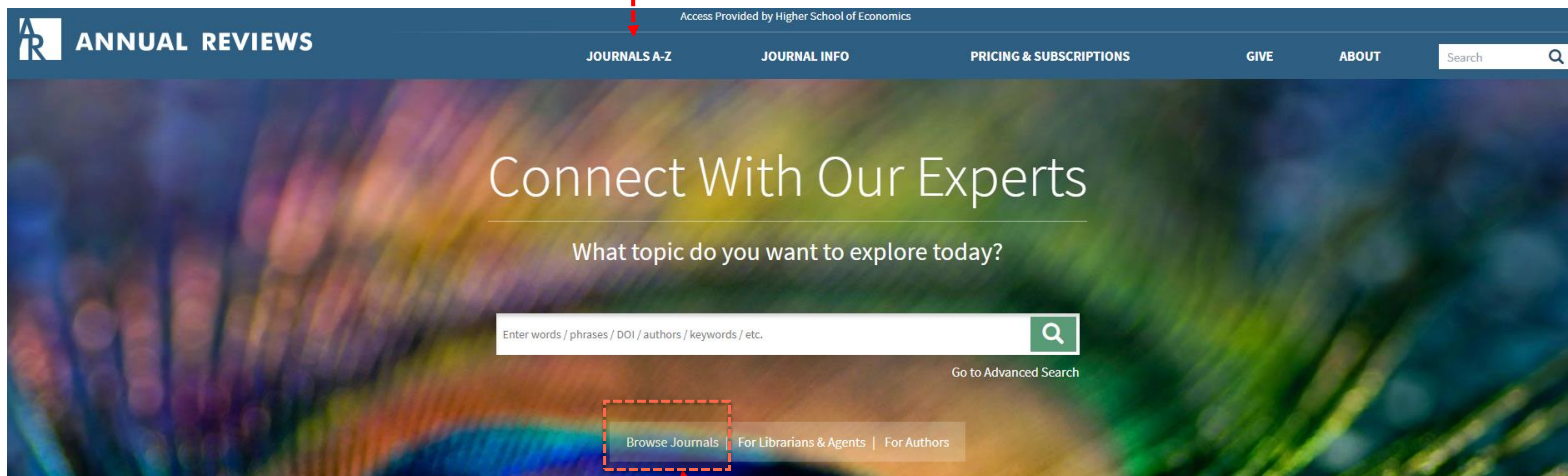
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Краткая информация о статье

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Spatially Resolved Photogenerated Exciton and Charge Transport in Emerging Semiconductors

Annual Review of Physical Chemistry

Vol. 71:1-30 (Volume publication date April 2020)

First published as a Review in Advance on November 22, 2019

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Информация об авторах

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KEYWORDS

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OUTLOOK: THE PRESENT AND FUTURE OF
SPATIOTEMPORALLY RESOLVED ENERGY
FLOW

DISCLOSURE STATEMENT

ACKNOWLEDGMENTS

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Abstract

We review recent advances in the characterization of electronic forms of energy transport in emerging semiconductors. The approaches described all temporally and spatially resolve the evolution of initially localized populations of photogenerated excitons or charge carriers. We first provide a comprehensive background for describing the physical origin and nature of electronic energy transport both microscopically and from the perspective of the observer. We introduce the new family of far-field, time-resolved optical microscopies developed to directly resolve not only the extent of this transport but also its potentially temporally and spatially dependent rate. We review a representation of examples from the recent literature, including investigation of energy flow in colloidal quantum dot solids, organic semiconductors, organic-inorganic metal halide perovskites, and 2D transition metal dichalcogenides. These examples illustrate how traditional parameters like diffusivity are applicable only within limited spatiotemporal ranges and how the techniques at the core of this review, especially when taken together, are revealing a more complete picture of the spatiotemporal evolution of energy transport in complex semiconductors, even as a function of their structural heterogeneities.

Keywords

heterogeneous energy materials, nonequilibrium dynamics, optical spectroscopy, spatiotemporal, diffusion, ultrafast microscopy

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Annual Review of Physical Chemistry
Vol. 71:361-390 (Volume publication date April 2020)
First published as a Review in Advance on February 24, 2020
<https://doi.org/10.1146/annurev-physchem-042018-052331>

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Abstract

Machine learning (ML) is transforming all areas of science. The complex and time-consuming calculations in molecular simulations are particularly suitable for an ML revolution and have already been profoundly affected by the application of existing ML methods. Here we review recent ML methods for molecular simulation, with particular focus on (deep) neural networks for the prediction of quantum-mechanical energies and forces, on coarse-grained molecular dynamics, on the extraction of free energy surfaces and kinetics, and on generative network approaches to sample molecular equilibrium structures and compute thermodynamics. To explain these methods and illustrate open methodological problems, we review some important principles of molecular physics and describe how they can be incorporated into ML structures. Finally, we identify and describe a list of open challenges for the interface between ML and molecular simulation.

Keywords

machine learning, neural networks, molecular simulation, quantum mechanics, coarse graining, kinetics

1. INTRODUCTION

In 1929 Paul Dirac (1, p. 714) stated,

The underlying physical laws necessary for the mathematical theory of a large part of physics and the whole of chemistry are thus completely known, and the difficulty is only that the exact application of these laws leads to equations much too complicated to be soluble. It therefore becomes desirable that approximate practical methods of applying quantum mechanics should be developed, which can lead to an explanation of the main features of complex atomic systems without too much computation.

Ninety years later, this quote is still state of the art. However, in the past decade, new tools from the rapidly developing field of machine learning (ML) have started to make a significant impact on the development of approximate methods for complex atomic systems, bypassing the direct solution of “equations much too complicated to be soluble.”

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The Effects of Changing Weather on Public Health

Annual Review of Public Health
Vol. 21:271-307 (Volume publication date May 2000)
<https://doi.org/10.1146/annurev.publhealth.21.1.271>

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RESEARCH CHALLENGES

CONCLUSIONS

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Abstract

• **Abstract** Many diseases are influenced by weather conditions or display strong seasonality, suggestive of a possible climatic contribution. Projections of future climate change have, therefore, compelled health scientists to re-examine weather/disease relationships. There are three projected physical consequences of climate change: temperature rise, sea level rise, and extremes in the hydrologic cycle. This century, the Earth has warmed by about 0.5 degrees centigrade, and the mid-range estimates of future temperature change and sea level rise are 2.0 degrees centigrade and 49 centimeters, respectively, by the year 2100. Extreme weather variability associated with climate change may especially add an important new stress to developing nations that are already vulnerable as a result of environmental degradation, resource depletion, overpopulation, or location (e.g. low-lying coastal deltas). The regional impacts of climate change will vary widely depending on existing population vulnerability. Health outcomes of climate change can be grouped into those of: (a) direct physical consequences, e.g. heat mortality or drowning; (b) physical/chemical sequelae, e.g. atmospheric transport and formation of air pollutants; (c) physical/biological consequences, e.g. response of vector- and waterborne diseases, and food production; and (d) sociodemographic impacts, e.g. climate or environmentally induced migration or population dislocation. Better understanding of the linkages between climate variability as a determinant of disease will be important, among other key factors, in constructing predictive models to guide public health prevention.

Key Words

climate change ; global warming ; heat waves ; waterborne disease ; air pollution ; vectorborne disease .

INTRODUCTION

Environmental health concerns have traditionally focused on toxicological or infectious risks to human health from local factors. As we enter the next millennium, it is becoming ever more evident that disturbances of natural ecological systems pose new risks to health. During the past 2 decades, population growth and the spread of industrialization, which

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THE EFFECTS OF CHANGING WEATHER ON PUBLIC HEALTH

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Key Words climate change, global warming, heat waves, waterborne disease, air pollution, vectorborne disease

■ **Abstract** Many diseases are influenced by weather conditions or display strong seasonality, suggestive of a possible climatic contribution. Projections of future climate change have, therefore, compelled health scientists to re-examine weather/disease relationships. There are three projected physical consequences of climate change: temperature rise, sea level rise, and extremes in the hydrologic cycle. This century, the Earth has warmed by about 0.5 degrees centigrade, and the mid-range estimates of future temperature change and sea level rise are 2.0 degrees centigrade and 49 centimeters, respectively, by the year 2100. Extreme weather variability associated with climate change may especially add an important new stress to developing nations that are already vulnerable as a result of environmental degradation, resource depletion, overpopulation, or location (e.g. low-lying coastal deltas). The regional impacts of climate change will vary widely depending on existing population vulnerability. Health outcomes of climate change can be grouped into those of: (a) direct physical consequences, e.g. heat mortality or drowning; (b) physical/chemical sequelae, e.g. atmospheric transport and formation of air pollutants; (c) physical/biological consequences, e.g. response of vector- and waterborne diseases, and food production; and (d) sociodemographic impacts, e.g. climate or environmentally induced migration or population dislocation. Better understanding of the linkages between climate variability as a determinant of disease will be important, among other key factors, in constructing predictive models to guide public health prevention.

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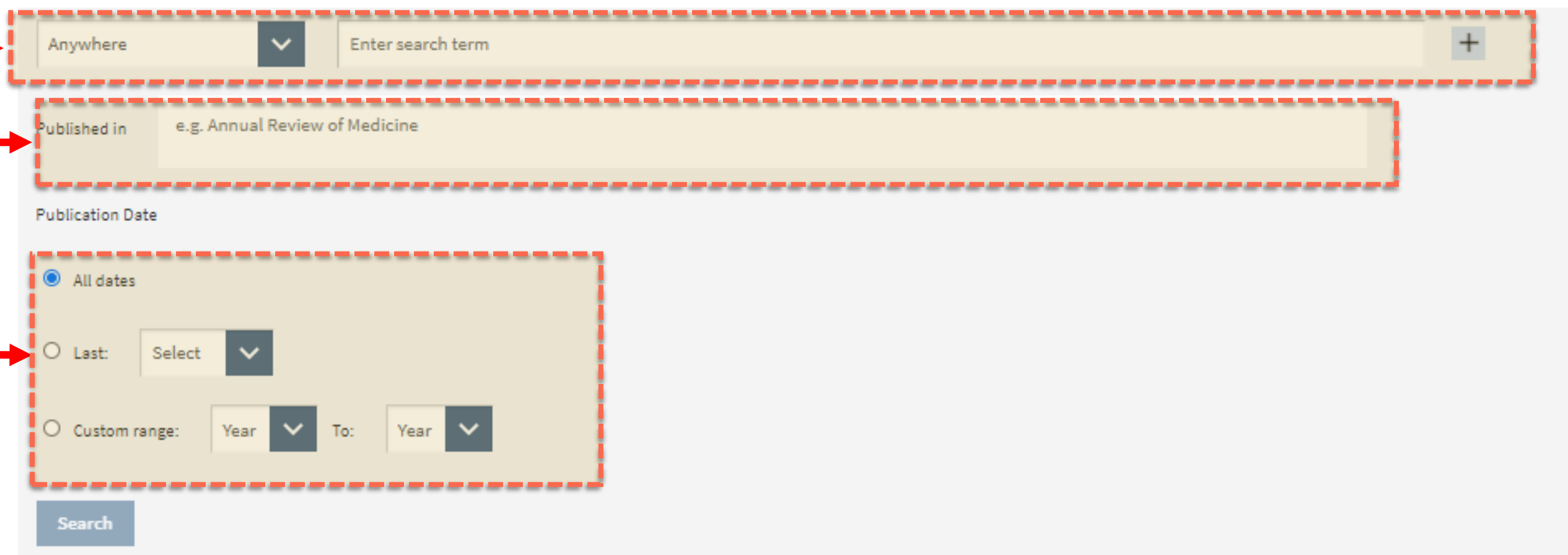
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