

## Tenth Annual “Research Fronts Report” Highlights Hot and Emerging Fields

To highlight fast-moving and emerging specialty areas of science, Clarivate™ has once again partnered with the Chinese Academy of Sciences (CAS) in a yearly report on the hottest fields in science, including data on the countries and institutions producing the work. The latest annual edition, *Research Fronts 2023*, marks the tenth collaboration between Clarivate and the CAS.

This latest report, like its predecessors, bases its findings on Research Fronts, which are self-organizing clusters of related research identified by citation analysis. Research Fronts form when clusters of highly cited papers are frequently cited together. This pattern of co-citation, as it's known, indicates that the papers share a cognitive link or point of commonality, such as a concept, hypothesis, method, or experimental data. With the co-cited papers serving as a foundational core, the other component of a Research Front consists of the subsequent papers that cite the core. These citing papers offer insights into how a given specialty area is progressing and evolving.

### An Organic View

A unique advantage of Research Fronts is that identifying these “nodes” of specialized activity does not depend on the judgments of human indexers or analysts. Instead, researchers themselves reveal these fronts in the course of publishing their work, when they decide upon the most pertinent and significant papers to cite. In this way, Research Fronts provide a more dynamic and “organic” perspective on how specialty areas form, grow, branch out, merge with other disciplines, and, possibly, dissipate, as new citation-based groupings reveal themselves.

This dynamic view of the research landscape is invaluable in providing knowledge and foresight to policymakers and administrators in governmental, academic, and commercial settings—as well as to anyone with an interest in the latest areas of concentration and activity in science.

As in past reports, analysts from the Institute of Science and Development, and the National Science Library of the CAS, collaborated with bibliometric experts from Clarivate, turning to the Essential Science Indicators™ database, which is built on the foundation of the *Web of Science™* index.

Analysts first consolidated the 22 subject fields in Essential Science Indicators into 11 broad specialty areas. Starting with more than 12,000 Research Fronts, representing papers published and cited between 2017 and 2022, the next step was to select the fronts containing core literature that is both highly cited and recent—an indicator of particularly active and fast-moving research.

Ultimately, the analysis produced 110 fronts that are especially active, or “hot,” as well as 18 emerging fronts, with the latter selected on the basis of notably recent core literature.

In addition to listing all 110 Research Fronts across the 11 specialty areas, the report's discipline-based chapters include detailed examinations of selected fronts, including rankings of notable nations and institutions whose contributions are central to each front's core and citing literature.

### A Broad Range

The latest compendium of fast-moving Research Fronts reflects a broad range of specialty areas and topics.

Although studies related to COVID-19 have receded in comparison to their high profile in the previous two annual roundups, the pandemic and its various facets still command attention. Research Fronts in

clinical medicine reflect the ongoing evaluation of antiviral treatments and the efficacy and effects of COVID-19 vaccines. Meanwhile, hot fronts in the areas of economics and psychology examine such aspects as the pandemic's lingering disruption of supply chains, as well as COVID-related effects on adolescent mental health.

In environmental sciences, a Research Front centers on the growing problem of microplastics in the environment—specifically, in agricultural soil, due to farmers' use of plastic mulch. On the same topic, recent research in an emerging front examines what is perhaps the most troubling effect of microplastics: the detection of the pollutant in human tissue.

Other Research Fronts highlight ongoing investigations across the scientific spectrum. In biology, an emerging front examines the phenomenon of “cuproptosis”—a recently identified form of regulated cell death induced by copper. Researchers are investigating the role of this process in cancer and other diseases.

In astronomy and astrophysics, scientists continue to study the characteristics and origin of fast radio bursts, the cosmic explosions that produce more energy in a fraction of a second than the sun does in a year.

Meanwhile, artificial intelligence continues to cast its shadow in many disciplines, from promoting “brain-inspired learning” in machines to affording deeper knowledge of the human proteome.

These examples, of course, represent only a small sampling of the 110 specialty areas highlighted in the report.

### **Fields and Nations**

Released concurrently with Research Fronts 2023 is the updated version of another yearly report: “Research Fronts 2023: Active Fields, Leading Countries/Regions”. This report provides a deeper view of Research Front activity, including extensive and nuanced metrics on national and institutional performance in the 2023 fronts.