In 2020/2021, the CIFAR research programs eligible to accept applications are:

Brain, Mind & Consciousness

The aim of CIFAR's ***Brain, Mind, and Consciousness*** program is to bring together scientists and scholars from a broad range of disciplines, from philosophy to cognitive and systems neuroscience, to explore the cultural, neural, and genetic bases of those aspects of consciousness that appear to be specifically human. Researchers within the program address core questions surrounding the neural basis and functions of consciousness; its development over time; its expression and detection in patients with brain damage; consciousness in other animals; the relation of consciousness to distinctively human practices such as music and language, and other topics. Currently, the program wishes to complement these core questions with novel emphases on (i) artificial intelligence and machine learning; (ii) virtual and extended reality, (iii) aesthetics, and (iv) development and education. Embracing these new directions will allow us to develop innovative approaches towards modelling the mechanisms and functions of consciousness, testing hypotheses about consciousness in immersive environments, and translating insights into consciousness into domains with societal and technological impact. We welcome applications for Global Scholar positions across the entire remit of our program, but especially from candidates able to bridge disciplines with expertise in our new areas of priority.

Boundaries, Membership & Belonging

All societies distinguish members from non-members. Evolutionary psychology suggests that humans are predisposed to distinguishing "us" from "them." But the contours of these boundaries are not hard-wired: they can and have shifted. Exclusionary definitions of national membership based on race, religion or caste are now widely perceived as illegitimate and in conflict with modern ideals of equal citizenship or common humanity. Global markets, international migration and transnational cultural flows further erode traditional definitions of "we." Some observers advance the cosmopolitan ideal that we are all citizens of the world, with no insiders or outsiders. Others, however, argue that in-group identities and a more bounded sense of "we" are essential to solidarity and collective action. The interdisciplinary ***Boundaries, Membership & Belonging*** program asks: How do the boundaries that humans draw, distinguishing 'us' from 'them,' carry both negative and positive consequences for collective action, our ability to produce collective resources, and the safeguarding of rights? Can ideas of national membership be redefined in ways that are both effective and legitimate? How do 'outsiders' become 'insiders'? What alternative memberships – above, below or across the contemporary nation-state – may be more effective and legitimate in the future?

Earth 4D: Subsurface Science & Exploration

The CIFAR ***Earth 4D: Subsurface Science & Exploration*** program brings together diverse expertise in geology, microbiology and planetary sciences with the shared vision to explore the complex co-evolution and feedbacks between planetary surfaces and the subsurface world. The program explores this aim through three interdisciplinary themes, WATER, LIFE and SPACE, intertwined with TIME as a 4th theme and overarching lens.

The program's long-term focus is on unravelling the complexities of chemical, physical and biological interactions in the Earth's subsurface and their implications for how we understand our own planet and our exploration of other

worlds. We have approached this challenge by questioning current understanding of subsurface architecture, life and energy. Together we propose new approaches to understand the physical and chemical controls on planetary subsurface architecture and how these controls and architectures impact and define subsurface biomes. We are exploring what is known and unknown about the origin, evolution and dispersal of subsurface life compared to the surface biosphere and what are the novel resources and models of subsurface energy that support planetary subsurface ecosystems.

The shorter term priorities of Earth 4D focus on refining our understanding of the limits of habitability in the subsurface, understanding the evolution of subsurface water over planetary time-scales and understanding the potential of radiolytic physical-chemical reactions in the subsurface.

Fungal Kingdom: Threats & Opportunities

The Fungal Kingdom spans as many as six million eukaryotic species, and is remarkable in terms of the breadth and depth of impact on global health, agriculture, biodiversity, ecology, manufacturing, and biomedical research. CIFAR's ***Fungal Kingdom: Threats & Opportunities*** program seeks to address the fundamental challenge of understanding the unique facets of fungal biology that impart a range of remarkable properties, with the goal of developing new strategies to mitigate threats posed by fungi and to harness their extraordinary potential. The program's interdisciplinary team encompasses exceptional strength in fungal genomics, infectious disease, food security, biodiversity, and chemistry, and is dedicated to bringing together state-of-the-art approaches in functional genomics, chemical biology, computational biology, cell biology, and experimental models of infection in a sustained collaborative research network. The program is tackling four grand challenges: 1) understand forces driving the emergence, evolution, and spread of fungi impacting plants, animals, and human health and society; 2) identify mechanisms of fungal adaptation and interactions with hosts and other microbes; 3) understand the evolution of resistance to fungicides and antifungals across the fungal kingdom; and 4) develop novel strategies to thwart fungal disease. The program will explore these themes with scholars from diverse areas of expertise, ranging from ecology and field work and epidemiology to genetics, genomics, and biology of fungal threats to the health of our planet and its resident species.

Humans & the Microbiome

CIFAR's ***Humans & the Microbiome*** program brings together world-renowned biological, clinical, and social scientists who explore human-microbiome interactions across interrelated time scales ranging from deep evolutionary history to physiological response times, and across changing social, cultural, and environmental landscapes. Building upon the interdisciplinary foundations within the program, it aims to challenge the status quo of microbiome research that focuses on individual microbiomes and particular diseases to explore how the microbiome impacts humans in changing environments. Specifically, the program is exploring human-microbiota interactions along three themes: 1) throughout the human lifespan, focusing on the bookends of life (early childhood and aging); 2) by expanding the focus from individual microbiomes to community (collective) microbiomes; 3) in varying and changing environments through time, broadly conceived to include physical and cultural environments, which affect individual humans and populations. The group is in a unique position to significantly reframe the fast-moving field of microbiome research, including both scientific and public views on how the microbiome impacts humanity. The program will explore these themes with scholars from diverse areas of expertise, ranging from social epidemiology and public health to environment, demography, and bioinformatics.

Innovation, Equity & The Future Of Prosperity

Innovation is essential to economic growth, health, and social and cultural well-being. However, both the opportunities to participate in and the benefits that emerge from innovation are unevenly distributed. Despite their substantial impact on inclusion and equality, we have limited knowledge of how innovation policies and practices shape outcomes, the conditions under which they succeed or fail, and the complementary activities (in education, finance, transportation, and other areas) that societies can undertake to produce better outcomes. By developing new ways to investigate how innovation interacts with distribution—and how both interact technological possibilities, historical trajectories, skills and education, regulatory environments, and other social, economic and political dynamics—the ***Innovation, Equity & the Future of Prosperity*** program produces new insights on how innovation and distribution work. It bridges existing scientific subfields, such as innovation studies and research on distribution, that are siloed and see little cross-fertilization. To do so, it brings together a truly multidisciplinary network of scholars from the social sciences, engineering, law and the humanities.