



LETTERS

Astronaut Buzz Aldrin walks on the surface of the Moon in 1969.

Edited by Jennifer Sills

Moon missions spark the human imagination

J. Berg's Editorial "A child of Apollo" (19 July, p. 203) is spot on. Fifty years ago, my older brother and I watched the Apollo 11 mission from India, sharing a worldwide sense of pride. The legacy of Apollo continues, with technological and medical benefits (1). It has inspired a new generation to think big and take great risks. Fifty years later, I watched Chandrayaan-2, India's lunar exploration mission, from the United States, connected to my brother by the internet though thousands of miles apart. The latest Moon mission provides a cause for celebration.

The public's exposure to advances in science, medicine, and engineering continues on many fronts. Fifty years ago, it was a luxury for a country to perform space exploration; now a private Moon lander is the buzz (2). A society may survive on its earthly activities, but it thrives on the human imagination that has given us rockets, satellites, and a continued search for knowledge. The Chandrayaan-2 mission drives a change in India that was initiated by the Apollo mission so many years ago.

Space exploration spurs global creativity, including China's successful Chang'E-4 landing on the far side of Moon (3) and the bold

attempt of the Israeli spacecraft Beresheet (4). Science can transcend time and distance to unite people and nurture their imaginations. If agencies like the Indian Space Research Organisation and the National Aeronautics and Space Administration worked together, along with China and private companies, another Moon journey would be possible. This is the time for the next generation to pursue their dreams.

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Radiation is not a political tool

With the recent tensions between Japan, Korea, and surrounding countries, Korea has begun to raise questions about the safety of radiation doses in foods and at Olympic venues in Fukushima (1). However, these allegations are not based on scientific evidence; the international scientific community has already resolved

that radiation doses from the Fukushima nuclear accident in 2011 are limited (2, 3). The current doses in Fukushima residents from external exposures are comparable to or lower than exposures in other countries (4), and additional doses from internal exposures are also negligible (<0.01 mSv/y) (5). This concern about radiation exposure is not a problem of radiation safety but a matter of the trust and social norms that govern radiation risk perception and generate radiation anxiety (6, 7).

Public trust has still not fully recovered, even in Japan (8), where about 50% of the population still perceives a likelihood that the health of the next generation has been adversely affected (9), despite the current scientific consensus (2, 3). Radiation anxiety is a root cause of social division and can create stigma, discrimination, and conflicts in society (10). This type of social division can also be accelerated in conjunction with emotion-based information spread by social media (11).

Radiation issues must not be used as a political tool. Politicizing radiation issues divides the public into factions and unnecessarily increases the public perception of radiation risks among individuals and the public, ultimately worsening social misery. Sharing scientific findings and engaging in calm discussions will reassure people in relevant countries and across the globe.

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Salmon in clear and present danger

During the summer of 2019, record heat events caused thousands of adult Pacific salmon to die of heat stress while migrating to their spawning grounds throughout Alaska (1). These die-offs come as many rivers in western North America have started transitioning to a regime of lower summer flows and higher temperatures during the salmon migration and spawning season (2). This transition, driven by warmer air temperatures and reduced snow and ice, will increase in severity and pervasiveness during the next few decades (3). Marine heat waves are also increasing in frequency (4), causing poor marine survival of many salmon populations (5). The threat of climate change is here and demands action now.

Curtailing the rise of global air temperatures by reducing carbon emissions is vital for salmon conservation. Aside from emission reductions, we urge federal governments to prioritize climate change resilience in fisheries and environmental policy. This means protecting evolutionarily unique populations of salmon as well as diverse landscapes that naturally vary in hydrology (6, 7). It also means that the remaining hotspots of salmon productivity



Record heat has caused salmon to die from heat stress, putting populations at risk.

must be safeguarded against degradation.

One such region is the watersheds of Bristol Bay, Alaska, where the controversial Pebble Mine has been proposed (8). Bristol Bay supports the most abundant sockeye salmon populations in the world, with a wild salmon fishery that provides 12,000 jobs and generates \$1.5 billion annually (9) while providing food security for rural Alaskans. However, the U.S. Environmental Protection Agency recently overturned its previous conclusion that the mine would cause irreparable harm to this ecosystem (10); barring congressional intervention, the final permitting decision is expected from the U.S. Army Corps of Engineers in early 2020.

Habitat destruction has driven the collapse of wild salmon fisheries from California to Washington, where 93% of wild salmon abundance has been lost (11). Intact habitat confers resilience to environmental change; the Pebble Mine would erode resilience when it is needed most. The warming caused by global carbon emissions will continue to kill salmon (12) and will kill the jobs and food security that salmon provide if our governments do not give them a fighting chance.

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