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"Nearly All Possible and Impossible Things Under the Sun"

Exhibiting Australian Science at Home and Abroad

NINETEENTH-CENTURY EXHIBITIONS SEEMED TO DISPLAY "NEARLY ALL POSSIBLE and impossible things under the sun," in the opinion of one London weekly, without any differentiation between the profound and the banal, the permanent and the ephemeral.[1] Hundreds of thousands, if not multiple millions, of visitors could view pigs as well as steam engines, performing fleas at the same time as paintings. Or, in the words of Horace Greeley, the famous American newspaperman visiting the Crystal Palace in 1851, "The ludicrous, the dissonant, the incongruous are not excluded from [the Great] Exhibition."[2] A trip around the halls at the Melbourne Intercolonial Exhibition in the British colony of Victoria over twenty years later might bring one face-to-face with Japanese vases, Australian Aboriginal tools, American harvesters, French hats, and Australian gold nuggets, not to mention an array of items to eat and drink and people to observe and, perhaps, with which to "flirt."[3]

Popular exhibits at the Crystal Palace and the later Australian show also included the physical elements of modern science, most notably the specimens, publications, and instruments created and used by scientists.[4] Among the many scientific exhibits in 1851 were telescopes, scales, microscopes, compasses, and air pumps. Alongside their complements, these composed "the sciences of the age in their various ramifications and objects," according to a

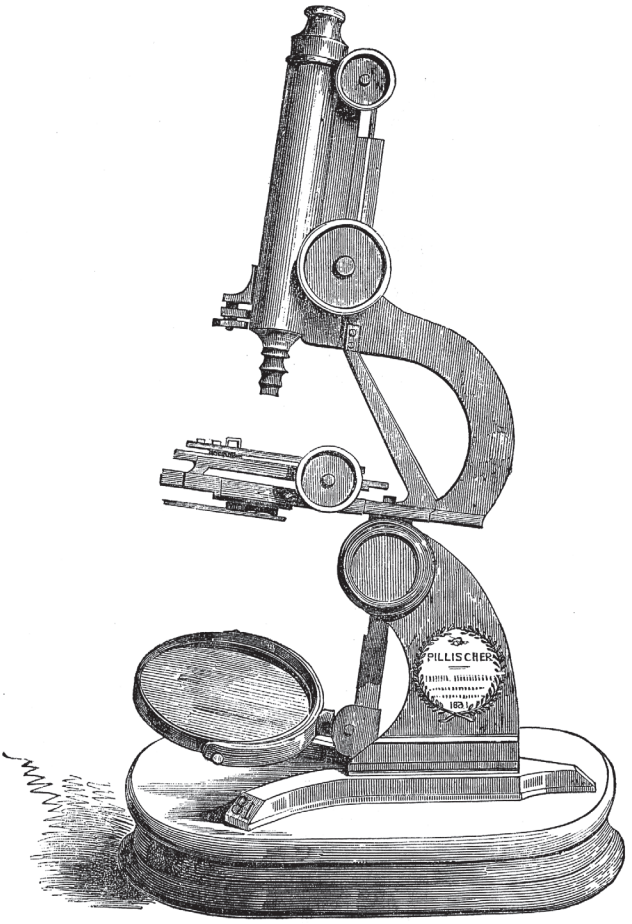

FIGURE 1.1.
"Microscope by Mr. Pillischer," the Great Exhibition, 1851. *Illustrated London News*, July 5, 1851, 35, courtesy of the British Library

prominent post-Exhibition public lecturer.[5] Alexander Ross's astronomical telescope and "Microscope, by Mr. Fillischer" (figure 1.1) drew the attention of the *Illustrated London News*, which provided text and engravings for that and other exhibits.[6] Visitors more inclined toward books could enjoy volumes with plant and other natural history specimens.[7]

Commissioners for the 1875 Melbourne Intercolonial solicited, among other exhibits, "Scientific Innovations, and New Discoveries" from throughout the Pacific region.[8] Much of what was exhibited in Melbourne—including zoological models and geological sketches, maps and botanical samples—was subsequently forwarded to the Philadelphia Centennial Exposition the following year for display alongside and linked to local manufactured goods and art.[9] The Australian colonies invited visitors to their own individual colonial courts at the well-attended American show. Geological samples, such as gold,

were among the most popular Australian displays, whether one visited displays from New South Wales or from Victoria.

The Philadelphia Centennial Exposition is nearly the chronological midpoint for this book. Earlier exhibitions include the metropolitan shows held in Sydney and Melbourne. Those were more locally focused, marking the centrality of the host city. They were popular in the 1850s. Building upon those precedents and their participation at the Great Exhibition, Australian scientists embraced intercolonial exhibitions in the 1860s and 1870s, events that emphasized not only the host city but the host colony and were often held as preliminary events to organize Australian contributions to overseas international exhibitions the following year.

Among many examples, the Melbourne Intercolonial Exhibition of 1866–1867 helped Australians get their bearings to send exhibits and representatives to the Paris Universal Exposition in 1867, and the Victorian Intercolonial Exhibition of 1875 ensured a better-organized, higher-quality, and more comprehensive Australian contribution to the subsequent year's show in Philadelphia. The apex of the international exhibition movement was in the 1880s. At that point, colonial cities were hosting their own ambitious shows. Calcutta and Melbourne each welcomed visitors, exhibitors, and displays. In fact, Melbourne hosted two international exhibitions during that decade. Major European cities, including Paris and Amsterdam, also hosted ambitious international exhibitions.

Scholars often downplay for sensible reasons the metropolitan and intercolonial exhibitions. They were hardly as bold or popular as the international shows. Their ambitions were more restrained. The exhibition halls were often fairgrounds or museums, rather than the memorable exhibition halls built specifically to host the later shows. On the other hand, they were important in the history of Australian public science as having local consequences and as providing the necessary opportunity to effectively organize for overseas exhibits and more direct personal participation. The major scientists and their staffs discussed in this book actively engaged those less well-known exhibitions. They often did so, though, with the dominant international exhibitions also in mind. Geologists intended not only to promote local science at smaller shows but also to connect that science to more global, and certainly British and European, science. That connection could be made more explicit and with more enduring legacies at the well-studied international exhibitions.

The bolder later shows considered in this book include the major Australian international exhibitions held in Sydney (1879), Melbourne (1880–1881 and 1888), and Adelaide (1887) and most, although not all, of the most popular and meaningful overseas ones. Among those were the series of Paris Universal Expositions (1855, 1867, and 1878), international exhibitions at London's

South Kensington (1862 and the early 1870s), and several held in the United States and on the European continent. The Vienna International Exhibition (1873) and Philadelphia Centennial Exposition (1876) proved particularly successful in generating a positive response to Australian exhibits. Those popular displays included local minerals and scientific texts.

One of the enduring themes running throughout the century was, not surprisingly, imperialism, or the Australian colonies' connections to Britain and the British Empire. Those connections were apparent in the world of exhibitions in at least two ways relevant for displaying Australian public science. Did scientists and visitors comprehend science from New South Wales as a "national" enterprise, as the result of either Australian or British nationalism, or did visitors and participants more often comprehend an "imperial" enterprise? The following chapters come to terms with this tension, although I do not offer a final answer, only some suggestions and examples. Some of the suggestions relied upon how science was exhibited. Were Australian samples exhibited alongside British ones, or in a British court, or were they clearly identified and separated in a recognized "New South Wales" court? The use of local names, sometimes Australian Aboriginal ones, might be interpreted as a more local definition of nationalism and a response to those only using common English and Latin names.

The enduring imperial theme also runs through the century and this book in the form of special British imperial exhibitions. There were a handful during the later nineteenth and early twentieth centuries, but this book focuses on only one: the Colonial and Indian Exhibition in 1886, held as part of a series of thematic shows at South Kensington during the early and mid-1880s. Each of the Australian colonies forwarded to London scientific displays and reports. Many also sent their own scientists. As discussed in chapter 2, those examples included the colony of Victoria, which officially dispatched Joseph Bosisto as botanist and colonial executive commissioner. South Kensington offered an instructive example of how "national" and "imperial" might be integrated in the public display of science.

Static objects and working instruments at the exhibitions were both part of publicly "staging science," the helpful term used by the postcolonial scholar Gyan Prakash in his consideration of science in modern India. His influential scholarship includes discussion of nineteenth-century scientific displays at exhibitions in British India.[10] Members of the Royal Society in England in 1851 had been particularly enthusiastic about many of the Great Exhibition's working, or staged, scientific displays, such as ones representing "the advanced state of magnetic science" in the host country. That "state" was well represented by instruments, although there was relatively little analysis of the data collected by them.[11]

Not surprisingly, science was performed and staged perhaps as much as if not more so than it was documented and analyzed, and that staging was most popular when connected not only to industrial and manufacturing processes but also to the sense of entertainment. There was explication and enchantment, a dual purpose for which exhibitions were well suited, as were other more permanent public attractions. Visitors to and residents of London could experience these at the Royal Polytechnic Institution, the Royal Panopticon, and Wyld's Globe.[12] At an equally fundamental level, exhibitions were also about comparison and competition. They were, in theory if not always in practice, examples of a viable marketplace of goods, experiences, and peoples.

By 1875 and the time of the Melbourne Intercolonial, visitors could expect to observe numerous and varied examples of science from the colonies of New South Wales, Victoria, South Australia, and Queensland. Those samples could include minerals, tools, plants, and research papers. The vice president of the Royal Society of New South Wales, the oldest Australian colony, was enthusiastic about exhibitions demonstrating and encouraging scientific progress. He remarked in Sydney that the Great Exhibition had "set all nations in motion, enjoying an international intercourse previously un-known, and with friendly emulation striving for progress and improvement."[13] That optimism was not only about trade and foreign relations but also about science and its public application and appreciation. Scientific exchanges and purchases, appreciation of what was unique and universal, and the immediacy of observations and samplings encouraged that Australian optimism at the exhibitions.

Such optimism was shared by others at the time, and it seemed to know no physical or chronological borders. The Australian's comments echoed the remarks of Prince Albert and the writings of Charles Babbage, one of England's leading scientists. Babbage, a mid-Victorian advocate of both science and exhibitions for whom the Crystal Palace was not a complete success, still considered the event a testament to the internal advantages of the "intercommunication of the difficulties, the doubts, and the discoveries" of scientists. He added that direct links could be made between men of science and "the manufacturer." That connection was advantageous to both, remarked Babbage, if not to the consumer, or general public, as well.[14] Such sentiments were also expressed rather strongly by Joseph Henry, the American scientist and keen advocate of his country's participation at the Great Exhibition, among other exhibitions. He envisioned significant public improvements from participating in exhibitions.[15]

That contagious enthusiasm for the generally accepted, mutually beneficial relationship between science and exhibitions was readily apparent to

contemporaries, but it has rarely received scholarly attention. That is, there is limited scholarship about science at the exhibitions, the popular impressions of those displays, and other related activities. A handful of studies address science at the Great Exhibition and at American expositions, but those are overwhelmed in number by the important studies of art, "human displays," commercial goods, nationalism, and architecture at the exhibitions. This book attempts to redress that relative absence by focusing on the roles of Australian scientists and science at major exhibitions during the second half of the nineteenth century.

This first chapter charts the history of Australian scientific displays at significant exhibitions, both at home and abroad. The Melbourne Intercolonial was only one among many Australian examples—whether those examples of Australian science were on display in Sydney, Melbourne, Adelaide, and Brisbane, close to home, or in distant Paris, Philadelphia, Calcutta, Vienna, and London. Science was a part of the first Australian shows held in Melbourne and Sydney in 1854 and continued at the ambitious Australian international exhibitions of the 1879–1897 period. The first of those was hosted in the Garden Palace in Sydney; the last, Brisbane.

One could cautiously chart a chronological narrative of increasing numbers and diversity of scientists and scientific displays as time went on, with the hosting of significant collections and visiting scientists at Sydney and Melbourne (1880–1881 and 1888) as perhaps turning points in strengthening the public roles of those active local Australian scientists and their understanding of public science. As noted above, the earlier shows in the Australian colonies demonstrated public science as civic science and, at times, as local science in comparison with science across the colonial borders. Melbourne could compare its public science with that of neighboring New South Wales. Perhaps, looking back, those do not seem to be significant developments in the longer-term narrative of science. But they were significant to contemporaries, although not as significant in Australia as the discovery of gold or the end of convict transportation during those years.

The later and larger shows at home and abroad encouraged comparisons between Australian science and scientists and those of much of the world. Hosting such events was also a claim that the colonies, or at least the host capital cities, had arrived as recognizable urban centers. That recognition included the development of scientific studies, societies, and museums. By the 1880s this meant Melbourne science could be compared to that practiced in Britain, France, Germany, and the United States, among many other nation-states. Those later exhibitions allowed Australians to show off their own science and learn from the science of modern nations, as they did in 1893 at the hugely popular World's Columbian Exposition in Chicago. It was not unusual

for foreign scientists to recognize Australian scientific contributions at those later shows.

Australian public science at the exhibitions included a rather broad approach to what constituted "science," although that category was distinct from art and manufactures, and the emphasis remained on what was new and innovative. Practical science was not ignored. Visitors could expect mineral samples with both scientific and economic purposes. Terms could be debated, though, and the era's political terms could be just as fluid as those defining an intellectual pursuit. Australian science could be noted as both "national" in the sense of being generated by a specific colony and "national" as being part of the larger British section. It could be defined as the British Empire, or not. It certainly was in 1886, when the Colonial and Indian Exhibition at South Kensington was limited to imperial participants, among whom were the several Australasian colonies.

The historical narrative of Australian science and scientists at the exhibitions begins in the 1850s, when science was considered part of civic and colonial life at the earliest local exhibitions. "One of the most interesting (not certainly in external appearance, but by reason of its historical associations)" of the objects on display at Sydney's Metropolitan Exhibition was "the last remaining portion of the tree, near which were buried" the remains of one of the early French naturalists to explore the Australian continent.[16] Considered a "relic" by the exhibition organizers, the natural antiquity displayed "the names and portions of a few words, carved on the bark a few feet about the ground." That exhibit brought together local interest in natural history, early exploration and claims, Australian Aboriginals—as their fires allegedly "defaced the inscription, and in parts obliterated it"—and connections with the outside world. The relic would be returned to France at the following year's Paris Universal Exposition.

Several hundred "Geological Specimens Illustrating the Succession of the Rock Formations in New South Wales" also greeted visitors to that first official Australian exhibition in Sydney in 1854.[17] A recognized local geologist, Rev. W. B. Clarke, had organized the scientific display of more than 400 samples not so much "to the illustration of the Geology of every separate District in the Colony, as to that of the whole—when viewed with respect to the Stratigraphical Arrangement of the Formations that compose it." Local rocks, fossils, ores, and minerals revealed "the high antiquity" and breadth of Australian geological formations, perhaps the "most ancient and primitive" forms available for scientific study. Here were scientific exhibits by periods and types, arranged in a "national" order and setting. Exhibits were also contributed by the Woodwardian Museum at the University of Cambridge. In total, there were over 430 samples.

Not to be outdone by their colonial neighbors, Melbourne's organizers solicited an array of scientific and "natural history" displays for their own first metropolitan exhibition in 1854: animals, skins, ferns, "eggs and nests," metals, minerals, and gems. Some were bound with their Sydney complements for Paris and its Universal Exposition the following year. All were expected to have attached to them "local" information: names, locations, and "other descriptive particulars." Visitors might also appreciate information about the commercial and economic applications of such scientific exhibits.[18] Significant Australian, if not "national," precedents for the display of science at exhibitions had been set at home in the colonies. Such scientific exhibits suggested a colony's and locality's "national" and public resources, rather than only those of a specific region, or district, or only as a part of the British Empire. The scientific whole of a colony's exhibited parts was greater than the sum of such parts—although visitors could still appreciate the more local origins of the displays. Integration of the local and the national was a scientific dress rehearsal for a broader integration, if not federation itself.

The 1854 shows, as was the case with many later Australian ones, were held as preliminaries to major overseas exhibitions. Those included the Paris Universal Expositions, scheduled once every decade between the 1850s and the turn of the twentieth century. Australian exhibits drew the attention of foreign visitors and experts at Paris in 1855. Among those expressing interest was Richard Owen, the well-known English scientist. He was "seen attentively examining" the geological and fossil specimens forwarded and described by Rev. W. B. Clarke.[19] The colonial press was happy to report that Owen was not alone in spending time admiring and studying the New South Wales samples.

In two more of nearly countless examples, the first Australian colony shipped to the subsequent Paris Universal Expositions of 1867 and 1878 collections of human and animal fossils, minerals and ores, zoological models, and stuffed birds. Those were catalogued and displayed in the "Class 45. Natural History, etc." category at the 1878 show as part of that larger scientific empire, or empire of science.[20] The 1867 scientific collections from New South Wales had attracted the attention of earlier visitors to Paris, one of whom noted "the very interesting geological specimens forwarded by Mr. R. Brough Smyth, Secretary to the Department of Mines," and the "large collection of fossil remains of mammals, birds and reptiles found in the caves of Wellington Valley and classified by Mr. Gerard Kreft."[21]

New South Wales was not alone. Its neighboring colony, Victoria, was also active in forwarding for display exhibits that fulfilled the criteria for "scientific" inventions, machines, and samples. The younger colony's commissioners and exhibitors took advantage of Sir Henry Cole's efforts to separate science from art by displaying scientific models and apparatus at the London

International Exhibition in 1873.[22] Those included a "new weighing apparatus," a drawing of a sundial, and samples of "Sullivan's Disinfectant Preparation." Additional colonial scientific contributions were arranged with the natural history and ethnology exhibits. Most exhibition organizers requested that scientific exhibits be displayed alongside other classes of exhibits from the participating nation in a national court, although those displays from the scientific world might be compared with their brethren from other nations in reports and catalogues.

Such was the situation at the Vienna International Exhibition, also held in 1873, at which Victoria filled its court with a vast diversity of goods and samples. Visitors could see in that array examples of science, among which were animal skins, "large trunks of trees," and cases of valuable minerals (figure 1.2).[23] In this more common arrangement, the impressive scientific exhibits were part of the colony's attractive court and understood as key components of colonial life. Touring the court, visitors could enjoy and study a cosmos of exhibits, within which science played an important role, but a role shared with and connected to other aspects of material and philosophical culture. Science from the colony of Victoria was not easily compared with science from France or from the colony of New South Wales, as it could be at Sir Henry Cole's London shows in the early 1870s. As executive commissioner, Cole collected and displayed scientific exhibits in their own special courts.

A third option for Australians was to significantly physically separate their exhibits from those of other participating polities. A separate structure might house the Australian displays, whereas at other shows they might be separated by a signpost or temporary division. Men and women walking around South Kensington in the early 1870s could note fossils, birds, coral, and other scientific exhibits at the special Queensland Annex. The colony's agent-general and government geologist oversaw an impressive collection of photographs, mounted samples, and exhibits in glass cases, representing the relatively new colony's natural history and the many products of the soil. Among those were tea, gold, cotton, and arrowroot.[24] Some of those exhibits were displayed both in London and Vienna.

Rev. W. B. Clarke was enthusiastic about taking advantage of such a colonial annex, or eventual colonial museum, particularly as it would attract the attention of British geologists and zoologists. The colony's scientific samples—fossil bones, "agate, limestone, basalt, etc."—had "gone home to be immortalized in the records of Science."[25] As will be seen in chapter 4, Clarke could be quite lyrical, calling upon his religious learning and duties when describing Australian science and scientists. He was not hesitant to be so in his public addresses, including the "Annual Presidential Address" before the Royal

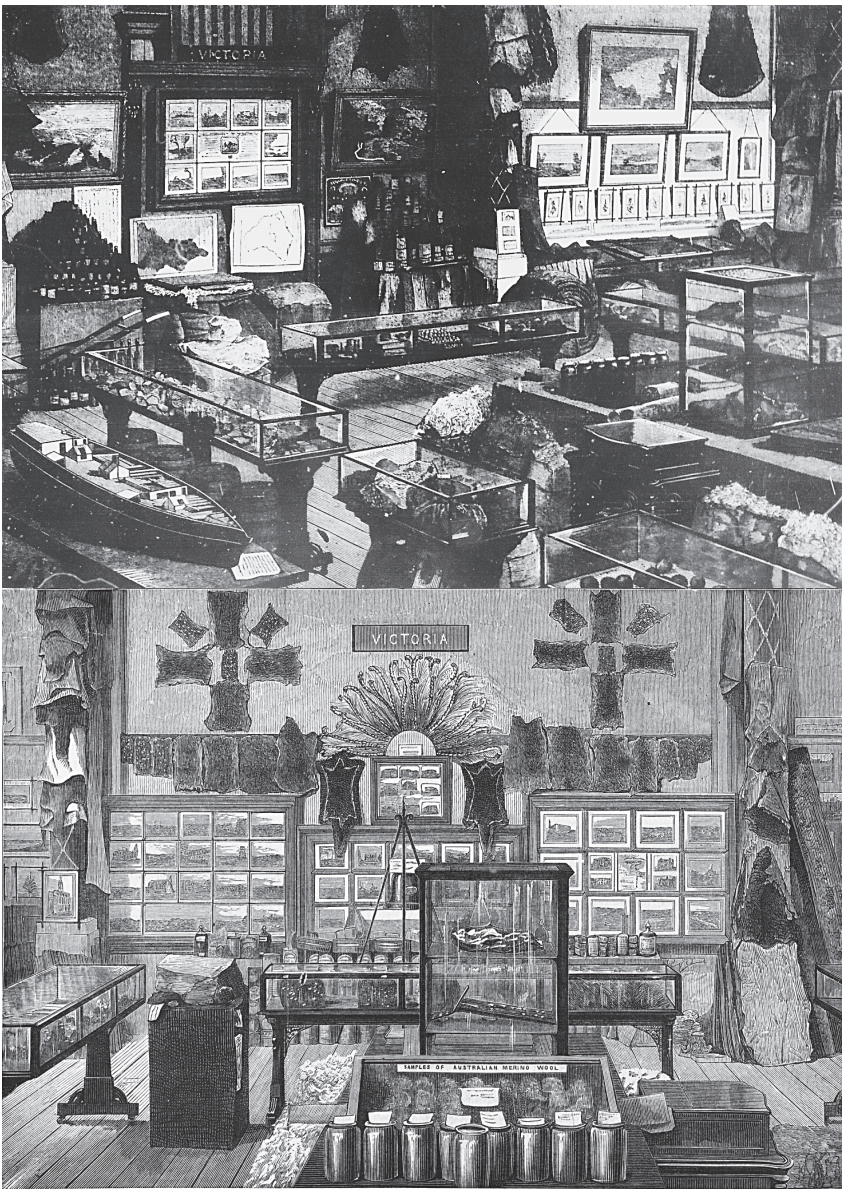

FIGURE 1.2.
"The Vienna Exhibition: Views of the Victorian Court." *Australasian Sketcher*, October 4, 1873, 125, courtesy of the National Library of Australia, Canberra

Society of New South Wales.

The 1880s were a busy time for exhibition participants—perhaps the busiest of all decades—and visitors expected to see scientific displays. Science had

become a normalized part of the exhibition experience. The noted Scotsman Patrick Geddes could easily connect scientific exhibits and lectures to his notion of "social progress." Reviewing international and industrial exhibitions of the future, he highlighted in 1887 the importance of including illustrations of the sciences "not only in detail, but what is now becoming more important, in synthesis." That is the application of science to public life and the public opening of science to men, women, and children. Commissioners and other organizers could invite astronomers, chemists, geologists, and biologists, as well as new men of science, such as anthropologists. While the "claims" of these last might be "set forth by the Indian Village or the like," their colleagues could contribute telescopes, "a tiny patch of garden plot . . . to make a type of botanic garden," and other components of the later-Victorian world of science.[26]

The Australians were not about to miss out on these exhibition opportunities during the final two decades of the century. New South Wales embraced the International, Colonial, and Export Trade Exhibition at Amsterdam in 1883. Reverend Clarke was among the loudest advocates of participation and he was not shy about his enthusiasm. He was particularly confident about the advantages to be gained for the colony by exhibiting mineral deposits and "representative blocks of coal from the leading carboniferous districts" and "suitable samples of the kerosene shale," also found in the colony. These were important for economic and scientific reasons.[27] Not alone, Clarke and his associates ended up filling courts and glass cases with a variety of scientific exhibits.

Those were collected, organized, and reported on by a group of public and private scientists, among whom were the director of the Sydney Botanic Gardens, the professor of chemistry and mineralogy at the University of Sydney, officers at the Department of Mines, and trustees of the Australian Museum. Those figures along with private citizens, such as James S. Bray, displayed a collection of fossils, minerals, stuffed birds, and Australian Aboriginal "ethnological exhibits." Private exhibitors sent clubs, fishing lines, "bark from which cord is made," boomerangs, and shields.[28] Colonial participation did not go unrewarded, as exhibitors from New South Wales and elsewhere in Australia earned medals and diplomas for minerals, maps, insects, birds, and other scientific exhibits.[29]

A few years later, the Australian colonies would join the many other "British possessions" for an exclusively "imperial" exhibition: the Colonial and Indian at South Kensington in 1886. This was part of a series of thematic exhibitions, and this one was limited to the empire.[30] "National" science that year meant "imperial," as much as a more local definition of the fluid term. Among many other colonies, New South Wales forwarded to central London

a series of stuffed animals, descriptive scientific catalogues, and scientific instruments. The exhibits included a "Recording Anemometer" and a "Compound Microscope," both manufactured in New South Wales. That point of origin was not insignificant, as it marked a homegrown scientific development. Those and the other scientific exhibits were provided by an array of sources, including the trustees of the Australian Museum, the government astronomer, and a private instrument maker.[31] Nearly all of the colonies had some scientific exhibits, and they were generally found with the other displays from that colony, rather than separated as a distinctive type of exhibit. Science was self-consciously part of both colonial society and the imperial enterprise, a component of public life and not separated from it.

Those and the hundreds of other Australian exhibitors before, during, and after the 1880s drew upon previous shows and exhibits, and also upon local public individual, institutional, and collective scientific labors. There were strong connections between those and the exhibitions, a mutually reinforcing relationship between public science at the exhibitions and science in public life outside of the shows. It was not uncommon for local acclimatization societies to contribute for display animal and plant collections, participation that was not reserved for one particular colony.

The Acclimatisation Society of Queensland was awarded a First Degree of Merit for its collection of economic plants at the Sydney International Exhibition in 1879.[32] Its Victorian branch cousin contributed several exhibits at the London International Exhibition at South Kensington a few years beforehand. Those displays included fish and fowl.[33] Ostrich feathers, Angora wool, and trout often filled the colonial acclimatization societies' cases and tables at shows both at home and abroad.[34] There was considerable local interest in the colonial societies' exhibition activities, an interest commonly expressed in local press coverage.

Other significant interactions concerning science occurred among the institutions of Australian civil society, notable scientists, and the display and study of science at the exhibitions. Science registered with the public, confirming its place in local society and public life, and the place at exhibitions for the voluntary societies filling up that public life. Mirroring Britain, the Australian colonies by the mid-nineteenth century offered residents and visitors mechanics' institutions, libraries, universities, and other examples of an active social and intellectual life, most particularly in the cities and larger provincial towns. Scientific demonstrations, publications, collections, and education were part of this flourishing civic life and not beyond the praise of local figures and newspapers.

This municipal public science was often connected to exhibitions. Members of such voluntary societies in both capital and provincial Australian cities were

inclined to collect and use exhibits for scientific authority and popular attention, often reaching out for such objects when intercolonial and international exhibitions were in either their own or neighboring colonies, or when colonial committees for overseas exhibitions wanted the institutions to participate. They also held their own exhibitions with scientific displays and activities.

The Mount Gambier Institute in South Australia was one of those organizations. Its leadership proposed "short lectures with scientific experiments" and museum displays for its own local exhibitions in the 1870s and 1880s, held at the same time as larger exhibitions in the colony's capital city, Adelaide. The institute offered a variety of permanent exhibits and temporary shows. One active local exhibitor and commissioner provided for the institute "an Illustrated Table referring to silk-worms," and the South Australia Museum in Adelaide forwarded to its provincial siblings zoological and mineralogical exhibits. Institute officers also collected and forwarded to South Australia's courts at overseas exhibitions various displays, including "Native Weapons and Implements of Chase" for the Paris Universal in 1878.[35]

The institute connected in other ways to promoting science at major overseas exhibitions, and those investments in time, materials, and labor reaped rewards at home. After the 1876 Philadelphia Centennial Exposition, for example, exhibition officers forwarded to the institute for its members' permanent reference various official and unofficial exhibition catalogues and reports. Included were the catalogues for the Portuguese and British sections of the American exposition, which both provided scientific information.[36] This was among the many local Australian examples of how different scientists and scientific communities were connected in the exhibition superhighway, a beneficial public connection for all parties and for the growth of public science.

Here was sincere public engagement with science before, during, and after the exhibitions. In those and other ways, the Mount Gambier Institute's scientific collection grew, and there were calls to establish within its building a permanent exhibition room. Local residents in 1885 collected funds for "a suitable room or rooms to be used as a lecture gallery and Museum." This effort resulted in donations of Aboriginal weapons and flora and fauna samples. By the end of the century, one contemporary claimed that the institute offered residents "a fine building, which besides being architecturally ornamental, supplies ample accommodation for every necessary purpose of such a structure," including holding its own scientific collections and exhibitions and contributing to others.

The institute began to play a more central role in the region's public scientific life, a development in a not insignificant way connected to its roles as home for local exhibitions, source for Australian and overseas exhibition displays, and repository of overseas exhibition materials. That regional

development was intimately connected to the institute's active participation in Australian public science at home and abroad, including the use of the "sciences of man" to generate a local sense of the past, which could fit the more universalist taxonomies of ethnology and archaeology.

The intercolonial and international exhibitions' popularity was not ignored by local scientific societies and institutions. Noting the impressive numbers visiting and enjoying Australian exhibitions, members of the Royal Society of Victoria lobbied for official participation in the 1873 Melbourne Intercolonial Exhibition. Proponents argued that the exhibition could help make the society's projects and science in general more popular in the colony, a self-consciousness, or awareness, about being part of what we have come to call "public science" and how that participation could assist the less public aspects of the scientific community. The society's council took advantage of the show to display "new discoveries and inventions" and to introduce "a popular element" in its membership and activities.[37] Council members reached out to non-experts and non-scientists in the community, but without intending to erode the integrity of its science behind doors. Refreshments were served and both theoretical and practical scientific topics discussed at a series of "extra meetings" before the exhibition officially opened. The results included new members and a renewed impulse for the Royal Society's efforts to foster science in the colony.

It is also significant that scientific publications prepared for exhibitions were not isolated from the growth of general scientific literature in the colonies of New South Wales and Victoria. The authors of exhibition essays also wrote essays for local periodicals and books at the time. As Mueller, Clarke, and their colleagues were organizing science exhibits for shows in Melbourne, Sydney, Paris, and London, they and their contemporaries could enjoy the birth of periodicals such as the *Sydney Magazine of Science and Art*. They could also contribute to it, either directly or indirectly. Initiated in the later 1850s by Joseph Dyer, this journal incorporated the proceedings and writings of the Australian Horticultural and Agricultural Society with those of the Philosophical Society—groups to which significant and numerous exhibition commissioners and exhibitors belonged—in an effort to call more attention to "the development of a taste for science, literature, and art," an effort mirroring that of local exhibition proponents.[38] Among the contributors was Reverend Clarke.

Science and scientists could not help but benefit from and contribute to the public discussion of such issues, as they could not help but benefit from and contribute to the complementary public exhibitions. Dyer and his associates were particularly keen on promoting scientific information to increase agricultural and commercial development—objectives shared by exhibition

commissioners and participants, Sir Redmond Barry in Melbourne, perhaps foremost among them—and thought that the ways to do so would include publicizing scientific writings, shows, competitions, and lectures. Thus, inquiry, knowledge, and competition would be combined for the reading public in the later 1850s as they had been for visitors and exhibitors at "the Paris Exhibition" a few years before.[39]

This was the case with Dyer's publication, as it was with others during the era, not only in the Australian colonies but also, for example, in British India. Madras was one of several South Asian cities in which advocates of science found expressions of their practical goals and visions of society in learned societies, periodicals, and exhibitions. Advocates and leaders included Alexander Hunter, who linked public projects in his capacities as superintendent of the School of Arts and Industry, exhibition commissioner and exhibitor, and member of local learned and scientific societies.[40]

That marriage of interests was not without its difficulties, some internal and others external. Many in New South Wales and Victoria shared Dyer's goal of developing "a taste for science, literature, and art," a goal expressed in the official and unofficial pronouncements at nearly all exhibitions, whether metropolitan or international. That was the case in the Australian colonies and in British India.[41] Unlike some of the exhibition participants, though, Dyer argued that "the constant attention to business, which is characteristic of colonial life, appears very unfriendly to the development" of art and science. Reverend Clarke and other exhibition enthusiasts would argue more often than not that exhibitions provided the venue by which that "constant attention" could be shared among science, art, and business, to the mutual benefit of all three. Did science or business represent the public interest? Was there a way to convincingly merge the two, generating a more local yet not parochial vision, a vision connecting various parts of the Australian colonies not only with themselves but also with the outside world?

For many Australians, Dyer and prominent scientists among them, there was a way: the exhibitions. Dyer proposed merging commercial, scientific, and cultural advancements in his call for a large Sydney exhibition, modeled on the recent success of the Melbourne Intercolonial of 1866–1867. That "Grand Intercolonial Exhibition" would "celebrate the 100th anniversary of the discovery of the colony" of New South Wales and, in doing so, improve local art, taste, science, business, and wealth.[42] Those events and experiences invited participation in a particular view of society, at the core of which was public science. This was a science that at least early on need not compete unsuccessfully with art, business, and entertainment. It could be a public and popular science.

Australian scientific participation at exhibitions in the colonies and else-

where also included more than collecting and displaying their own scientific materials or writing about local scientific specimens and achievements. Australians also sought non-Australian scientific exhibits for exchange and purchase, some of which were then distributed to provincial institutions. Before traveling to Philadelphia for the Americans' Centennial Exposition, commissioners from New South Wales were instructed to obtain foreign fossils, minerals, rocks, physical and mechanical scientific apparatus, and information about scientific education and museums for use and study back home.[43] Various scientific exhibits, timber and mineral displays among them, returned with the Australian commissioners. Similar activities unfolded during and after other American and overseas expositions.

Whereas early Australian scientific exhibits were limited in number and scope, the same could not be said about the expectations of local commissioners. They were quite confident that scientific displays would address fundamental colonial dilemmas and provide essential education for the general public and, in some cases, children in particular. Advocates of Sydney's Intercolonial Exhibition in 1870 concluded that knowledge about Australian flora and fauna—including knowledge on display at their show—might very well prevent "the disastrous termination" of so many local expeditions and enterprises resulting from "the pioneer's ignorance of the natural products" in the colonies.[44]

Local scientific knowledge exhibited at the Sydney exhibition could prevent the ironic starvation of so many "in the midst of plenty." Exhibited and available for study were various natural forms that even "the lamented Burke and Wills" could have eaten. Survival and wealth were two of the foremost gains to be realized when scientific exhibition displays worked in tandem with "the study of natural history at our schools, the establishment of district museums," and the general education of children to observe the "habits and economy of different animals," most particularly the useful ones.[45]

By the later 1870s, Australians organizing their own larger intercolonial and international exhibitions presented to the public rather ambitious science displays and thus transcended earlier educational and entertainment goals. Visitors touring the Garden Palace at Sydney's International Exhibition observed extensive displays for "Classes 300–307. Scientific and Philosophical Instruments and Methods." Those included local chronometers, scales, and timepieces as part of the "Education and Science" category.[46] Reports were quite enthusiastic. Less than ten years later, Adelaide's Jubilee International Exhibition in 1887 offered judges and visitors scientific instruments, methods, and samples under a wide "Education and Science" category, which included four distinct sections: "Educational Systems, Methods," "Scientific and Philo-

sophical Instruments and Methods," "Engineering, Architecture, Maps, etc.," and "Physical, Social, and Moral Conditions of Man."[47]

Among the judges at the Adelaide exhibition were local professors, engineers, and government officials, whose reports included discussion of over 170 separate geological and mineralogical exhibits, as well as the evidence in the exhibition halls of the growth of local chemical manufactures. A special jury convened to evaluate "Scientific Instruments." Its members subsequently awarded for their display a variety of Australian, European, and British exhibits, among which were instruments to weigh and measure. Some jurors noted the electrical and telegraphic displays appealing to the contemporary interest in those practical applications of science.

Keen-eyed visitors might have also detected the connections between science and the host colony's own territorial ambitions. Those ambitions focused on "The Northern Territory," adjacent to South Australia, and an allegedly politically unclaimed space represented at the exhibition by its own Northern Territory Court. Claims were expressed in the interest of not only economic development but also scientific knowledge particular to the territory, knowledge which South Australian scientists could label, study, and explain.[48] Science was part of claiming at the very public exhibition the territory for the colony of South Australia, not for all of Australia or for Great Britain.

The quality and variety of Australian scientific exhibits sometimes surprised foreign visitors. That was the case at Melbourne's Centennial Exhibition in 1888, where the American commissioners were impressed with the Australian exhibits in "Group 2. Educational and Instruction, apparatus and processes of the liberal arts."[49] Those included materials from Australian scientific and learned societies, scientific expeditions, and zoological collections. The Americans' official *Report* concluded that such scientific exhibits could be balanced against the predominance of "the natural products of these young countries." Australia might be a socially new country, but it was geologically very old and thus could look forward to a promising scientific future. That promise was made more tangible and attractive when scientific exhibits suggested commercial, as well as intellectual, benefits. Queensland's "economic plants" at the Centennial show realized those criteria. The colonial botanist who organized that exhibit made certain to highlight in both the display and the accompanying literature those vegetable substances which Australian settlers and Aboriginals had applied for practical and economic purposes.[50] The scientific lesson in natural history was also one in commerce.

The promise suggested by scientific displays—including those commented upon by the Americans visiting Melbourne—was sometimes greater than the Australians' performance, reminding Australians and their overseas

co-exhibitionists that theirs was, after all, a relatively "new" and distant society. Its fruits could be more readily and convincingly found in the displays of raw materials and commercial goods. Gold nuggets and merino wool were certain to capture and hold the public's eye at the exhibition with more certainty and fanfare than most science displays, but this does not mean that scientific exhibits were ignored or not appreciated as valuable. At times, though, Australians were not able to fill all of an exhibition's scientific categories. Reports from Sydney's Intercolonial Exhibition in 1870 record no entries for a variety of scientific objects, such as air pumps, hydrometers, and chemical and electrical apparatus.[51] Whether no exhibits in these categories could be found or no exhibits of good enough quality to be listed in the catalogue were available cannot be determined from the remaining records, but the end result was the same: the official report lists "No entry" for those classes of exhibits.

It was also true that Australian organizers could not find local experts to evaluate exhibits for all of the scientific categories in 1870. Melbourne and Sydney were, after all, examples of "comparatively small" communities in general and in the world of scientific expertise more specifically.[52] That being the case, though, specific scientific areas, such as astronomy and geology, were well represented by local exhibits from local scientists, who also described and judged exhibits. Among the other concerns expressed at the time was ensuring that judges should not also be exhibitors in the categories they were evaluating and that there should be no familial or business connections between the judges and the exhibitors. Exhibition commissioners were determined to guarantee or at least appear to guarantee to the public both "competence" and "impartiality." Skill and experience were also valued, as was noted by Australian observers of the juries at the 1855 Paris Universal Exposition.[53] Those concerns were not unique to Australian exhibition organizers, participants, and observers.

The absence of a particular display or the limited number of experts and judges in a specific scientific field was not necessarily a reflection of the depth of commitment on the part of many scientists, public officials, and others in general Australian society. Members of the Australian learned community in particular attempted to develop local science in ways that would improve manufactures, prestige, and perhaps social order—not always in each and every scientific field and not always as an extension of what the British were doing or wanted. Some Australians advocated at the time of the exhibitions that while "science culture" was the very "mainspring of advancement in arts and manufactures," that relationship was best applied to local circumstances and goals after consideration of what German scientists were doing, rather than what their English counterparts were undertaking.

H. C. Russell, vice president of the Royal Society of New South Wales, advised his listeners and readers in 1877 that the best way to avoid decline and "deterioration" was to not only keep science in the foreground but to do so in the ways that Germany was doing. His evidence? German advances in chemistry and engineering. "Now England has lost one of her best customers and found a rival instead."[54] His message was not intended for the English but for the Australians—or, more particularly, the colonists in New South Wales—and it might be addressed by developing science, scientists, and the scientific enterprise at exhibitions, whether in the colonies themselves or at events hosted by overseas countries.

Either way, there was much to learn in the public display of science, a display with a potentially non- or even anti-British "national" orientation, and one that contributed significantly to answering Australia's "national" and "social questions." In other words, scientific exhibits and the participation of scientists helped both Australians and others answer who was an Australian, what was Australia, and how Australians were experiencing a particular modernity. That was one increasingly on their own terms, or at the very least not solely on British terms. This was notably the case when science and industry merged, such as, once again, with impressive German exhibits at shows such as Chicago's World's Columbian Exposition in 1893. The colonial botanist from Victorian corresponded with a visitor thusly impressed.[55]

The German and other science exhibitions were fundamentally "Western" displays, sharing their essential organization, explanation, and wonderment. The Australian science displays were also in good part "imperial" or "Western" ones, but not entirely so. They were part of local public science in the colonies and often according to more local rules, expectations, labels, and uses. The ways in which they were exhibited and diffused did not necessarily or without contest reflect imperial hegemony but rather expressed the complex interplay of local and distant material culture and ideas: in some cases, produced overseas but consumed at home in the colonies. The exhibitions could be turned, in Mueller's view, to clear Australian or, more specifically, Victorian advantages, commercial, intellectual, and scientific in nature, which might coexist with British interests and science and would do so in and on increasingly Australian terms.

Such Australian advantages could be gained by using local names and information about local uses when organizing and labeling displays, as had been the case with scientific items solicited for Melbourne's first exhibition in 1854.[56] Mueller participated in this effort from those early days, again both at home and abroad, as a government official and leader in the local scientific community. He was not only colonial botanist for Victoria and director for many years of the local botanical garden; he also participated in expeditions

and surveys and actively served the local scientific voluntary societies and institutions, the Royal Society branch among them. Exhibitions were a further illustration of his deep interest in educating both publics about local botanical matters. His use of and commentary on Australian Aboriginal and settler names and applications for timber displays were intended to make them, and thus science, more accessible to local exhibition visitors and more informative for and accessible to those unfamiliar with Victoria or Australia in general. This was "a science of our own," and a public one, as well.

Mueller was not satisfied using only the officially recognized scientific titles and Australian Aboriginal names. He advocated also including "the English and common, as well as the scientific and Latin names" when labeling samples for the general public. That was a call with a local antiquarian, if not democratic, ring to it, or at least a ring of larger accessibility, and one that coexisted with a more universalist and global one.[57] It was a local measure without being parochial, or disconnected from the larger world of science. The local and the universal were not inherently contradictory or incompatible. The local imperative helped drive the botanist's museum and exhibition labors; but it did not limit them or their public presence. In fact, he expanded that presence. Mueller noted that the Melbourne museum offered "a popular institution as well as a scientific collection" for the colony and its visitors, so that the common Aboriginal and English names known to the local population and English-speaking visitors should be attached "wherever applicable."[58]

Mueller was convinced that his essay on "Australian Vegetation, Indigenous and Introduced" and the various colonial scientific exhibits for Melbourne's Intercolonial Exhibition in 1866 and its successor the following year in Paris would provide New World "teachings of science" to the Old World in areas such as botany, geology, and forest culture.[59] Such "teachings" could include local labels and samples, and also local ways of representing such samples, or the technologies of representation and organization. Mueller thought that he might have been the first to use "woodbooks" at the exhibitions for displaying samples, a rather convenient way to publicly display timber. The historian of science Linden Gillbank notes that Mueller adopted that method at the 1862 London International Exhibition, subsequently had "a series of them made," and then later sent them off for the colony's court at Philadelphia's Centennial Exposition. That was not the case at Melbourne's International in 1880–1881.[60] For some reason they were not used at that local international exhibition. Might not those and other public teachings and technologies of information have helped legitimate Mueller, white Australians, and their visions of the integration of science, society, and the nation? That might include, in Mueller's terms, "the occupation of the territory."

Exhibition collections, labels, and exchanges suggested a subtle, collaborative, and integrative approach to the local, colonial, imperial, national, and global scientific enterprise, one that crisscrossed social, cultural, and political borders. Naming claimed the land and its materials, past, and peoples for Victorians and Australians as much as, if not more than, for the British or their empire. The act of such claiming was part of the longer-term process of defining the nation and society in increasingly, but by no means exclusively, local terms and of naturalizing the presence and authority of not only earlier settlers and scientists but also the new Australian-born generation. Mueller's reports and collections informed English and European scientists and their publics about colonial or local scientific practices and revealed how the response to imperial and other overseas calls for scientific knowledge encouraged local and, at times, distinctive public developments, as well as the spread of English, European, and imperial practices.

Science and scientists played important roles in such larger intellectual, social, and practical developments, roles that induce us to return to some fundamental questions about public science in the Australian colonies: How else did science interact or register with the general public, or civil society, or how did the exhibitions connect with public life beyond the events themselves? What in practical terms did scientists do before, during, and after the exhibitions, and thus what were some of the longer-term consequences of their exhibition activities? Those are specific matters of who, what, and when, and more general and contextual matters about meanings, which framed how Australian scientists undertook their exhibition activities and, in turn, how such activities were understood by the general public, whether Australian or not, and by more formal governmental bodies, again whether Australian or not. Addressing this series of questions helps us better understand the institutionalization and growth of public science, or an Australian science "of its own" in the words of the New South Wales public speaker in the 1830s.

The following chapters tell together a story of the ways by which Australian scientists negotiated and shaped the scientific, professional, and material culture networks crisscrossing the Australian colonies, the British Empire, and much of the world during the nineteenth century. Those networks converged at the exhibitions, where scientists from the Australian colonies exploited advantages, encountered obstructions, and developed out of both relationships conducive not only to their own personal advancement but also to the advancement of public science. Such achievements were not secured without personal and collective costs, as will be discussed.[61]