Chapter 2
A Pictorial History of the Early Days of Computational Neuroscience: The CNS Meeting Posters

James M. Bower

Abstract In addition to its oral history, the CNS meeting also has a graphical or pictorial history represented by the series of posters produced for CNS*93–CNS*03, and explicitly captured in the poster produced for CNS*10, which represented the meeting's transition into its 20th year. These posters, reproduced in annotated form here for the first time, hang in laboratories around the world and in the halls of the U.S. National Institutes of Health, and represent in their own way, the history of computational neuroscience.

Chapter 1 in this volume recounts an oral history of the origins of the CNS meeting. This chapter in some sense tells the same story, through the posters produced for the CNS meetings (Fig. 2.1). The posters reproduced here reflect those produced from 1993–2003, as well as the explicitly historical poster produced to celebrate the beginning of the 20th year of CNS meetings. The posters reproduced here were created in close collaboration with two artists, Erica Oller (CNS*93–CNS*2000) and Bonnie Callahan (CNS*2001–CNS*2003 and CNS*2010) and can be found on the walls of laboratories around the world as well as in the halls of the U.S. National Institutes of Health.

So, why reproduce the posters here? In keeping with the theme of this book, this art itself reflects the growth and development of the field. Even a cursory examination should make clear that each is allegorical, blending some characteristic of each meeting's venue with some perceived aspect of the field of computational neuroscience. It is important to note that because neither artist had any direct association with the field of computational neuroscience, all implied interpretations regarding the field should be entirely attributed to me. This, in fact, is another motivation for publishing the posters with explanations. Through the years I have been quite

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Fig. 2.1 So many years, so many posters

amazed with interpretations I have heard as to their significance, especially with respect to the presumed representation of particular individuals. While it does state in the text at the bottom of the poster produced for CNS*93 that "any similarity to computational neurobiologists either living or dead may be intended," (Fig. 2.3)

Fig. 2.2 Who dat?

in fact, in the majority of posters very few of the figures represented real people. It clearly was my intent, however, to capture some sense of the CNS meetings and the computational neuroscience enterprise. To this point, some years ago I was visiting MIT and noticed the original CNS*93 poster (Fig. 2.3) hanging on the wall behind a receptionist. She did not know that I had anything to do with the design, so when I asked her where the rather odd poster behind her desk came from she said, "I have no idea, but they sure got the craziness around here right." I couldn't have asked for anything more.

In the brief descriptions of the posters that follow, I will mostly provide the most general context, refraining from detailing every buried meaning and significance. Like the brain itself, I believe that one can generally discover more, by looking closely (see photo of students at CNS*09 in Berlin: Fig. 2.2). To encourage that exploration, or just to decorate more laboratory walls, high-resolution images of each poster can be obtained online: http://www.genesis-sim.org/CNSposters.

We were far too busy organizing the first CNS meeting to generate a poster. Accordingly, the series of CNS posters began with the second meeting held in Washington, DC, with a poster designed to represent the complex state of computational neuroscience "hung" on the beautiful and complex dendrite of the cerebellar Purkinje cell (Fig. 2.3). The explicit reason we took the meeting to Washington was

Fig. 2.3 Beware theorists

to expose federal funding agencies to computational neuroscience as a field deserving support. One can see a funding fight taking place in the geographical center of the dendritic tree while a poor young theorist (no despite the beard not a young, svelte Bill Bialek) is grasping at a few dollars, while a fully funded experimentalist and his rats sit contently just above.

The poster was also intended to contrast the still largely detached experimental and theoretical efforts. Therefore, we see two industrious scientists struggling to impale the Purkinje cell soma and a third clearly in love with his section of the dendrite. However, also note the fellow spreading TTX apparently at random, unguided by theoretical considerations. All theorists in the poster are located on the margins of the dendrite, with one in the lower right explicitly refusing to consider the complexities of real biology. Observing this conflict, a concerned experimentalist clutches both the core of the dendritic tree and his data. In the upper left three collaborating modelers seem confused as they examine their computer screen while the theorists in the most precarious position (other than the one about to fall out of the tree altogether) are sitting on the top right, engaged in translating the complex geometry of the Purkinje cell into the standard mathematical formulation for a Hopfield Neural Network. While clearly excited about the possibilities, they seem oblivious to the two experimentalists sawing through the branch (limb) on which they are sitting. In this case, the theorist enthusiastically directing this effort is Christof Koch (the only real person represented in this poster), my friend, and colleague at Caltech and then fellow director of the Methods in Computational Neuroscience Summer Course at the Marine Biological Laboratory in Woods Hole. As discussed in the introduction to this volume, the CNS meeting itself originated in part from a concern that the neural networks community might not be paying enough attention to the actual structure of the nervous system, although in fairness to Christof he always has.

Finally, I also want to mention explicitly one unfortunate misinterpretation that I know exists concerning this poster. It is my understanding that this is the only one of the CNS posters that is not hanging in the halls at NIH, as there was some concern that the somewhat darker skinned young female graduate student in the center of the tree wistfully dreaming of graduation could be interpreted as implying sloth or laziness. This is absolutely not the intention. Instead, I wanted to give the sense that even in the nasty political mix of science and funding, and abstract and realistic modeling, it is still possible, especially for young scientists, to dream and aspire.

CNS*94 and *95 were both held the Double Tree Hotel in beautiful Monterey, CA, at a time when we thought it would be logistically easier to have the meeting each year in the same place (and why not Monterey?). Accordingly, this poster was originally produced for CNS*94, but was so well received, and we felt so beautiful, that we decided to use it again for CNS*95. As a consequence, I can now confess, one reason for deciding to move the meeting in 1996 was to provide a new source of inspiration for the CNS poster.

Of all the CNS posters, this poster is at the same time the simplest and perhaps the most graphically complex (Fig. 2.4). The thematic simplicity is based once again on the perceived importance of hauling in federal funding to support a growing field. In fact, perhaps in part as a result of locating CNS*93 in Washington, DC, CNS*94 and *95 were supported by grants from no less than five federal agencies, four at the National Institutes of Health and an additional grant from the National Science Foundation. (Support for the original CNS meetings from the office of Naval Research had been withdrawn as commemorated in the CNS*98 poster as

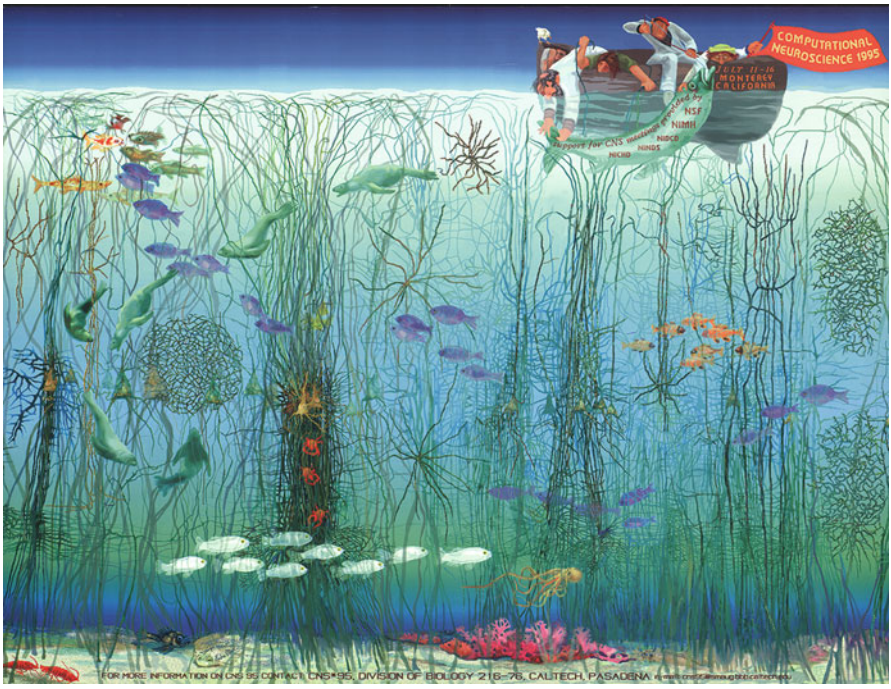

Fig. 2.4 What a nice catch

discussed below.) Of course the complexity of this poster is manifest in the structure of the Kelp forest, which on closer inspection can actually be seen to represent the neuronal circuitry of the mammalian primary visual cortex, beautifully and carefully rendered by Erika Oller. Monterey Bay and especially the Monterey aquarium (where the meeting banquet was held) are famous for their kelp forests, and visual cortex was then and remains today one of the most studied subjects in computational neuroscience.

This poster is also probably the least political of all the posters, with one feature as an exception. When the poster was first designed, several members of the organizing committee felt that it contained too little explicit information about the meeting itself. In particular, they believed that including a list of speakers would attract more participants. As discussed in the introduction to this volume, our emphasis was always more on students than on invited speakers, and as should already be clear, my motivations for poster design did not only include advertising. However, in deference to the concern I added eight white "speaker fish" floating along the bottom. If you look very closely at their fins, you can actually see the names of the speakers (I think ☺). One final historical note is that this poster includes a meeting email address. While younger scientists might find it hard to believe, in fact, the CNS meetings were one of the first to make use of the Internet for communication and advertising.

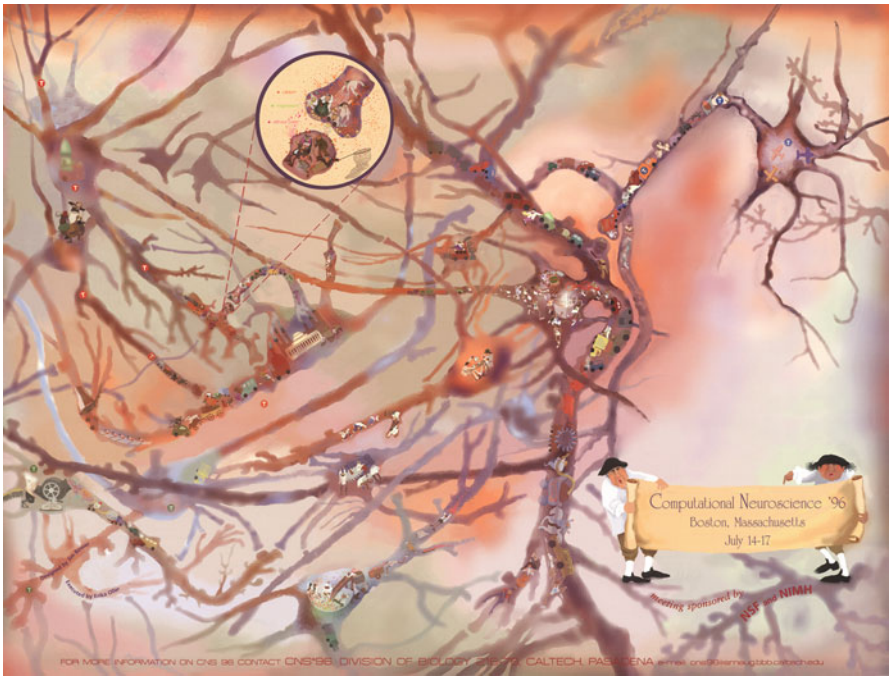

Fig. 2.5 Lost on the MTA

After 2 years on the west coast, the organizing committee decided to move the meeting back to the east coast, and what better place than Boston. Of all the CNS posters, this poster is the one whose symbolism has apparently been the hardest to decipher, even for people living in Boston (Fig. 2.5). While neurobiologically representing the complexities of intracellular trafficking in a small network of neurons, the poster itself is based on the also complex traffic patterns in Boston. Accordingly, in the upper left is Logan airport, with the T's representing the various stops on the MTA. Note also the large synaptic connection between Harvard and MIT, with characteristically (for each institution) attired pre- and postsynaptic faculty. With respect to computational neuroscience, in 1996 MIT was definitely presynaptic. There are many other bits of Boston both modern and historic represented in this poster (note for example the somewhat industrial effort at Boston University), but like molecular trafficking and the streets of Boston, the details are too complex and numerous to go into. Holding the CNS meeting in Boston fully established the importance of moving the meeting each year, as easier access for students resulted in a doubled meeting attendance and great vitality. The Boston meeting was also the first performance at a CNS meeting by Ramon and the K-halls (Fig. 2.6).

The "Computational Gang" definitely came to town in beautiful Big Sky Montana in the summer of 1997 (Fig. 2.7), however, in addition John Miller and I were also at the same time engaged in establishing the new Computational Biology Institute at nearby Montana State University, which shortly thereafter became John's new

Fig. 2.6 What would Ramon have thought?

academic home. In the poster, John is represented by the tall figure in the center with the orange pants and red shirt about to draw calculators from his holsters. As shown in the photograph, John's entrance to the meeting itself was on horseback, being "hauled in" as the Computational Neuroscience Unibomber (Fig. 2.8).

This poster also represents the field of experimental neuroscience as a kind of lawless western town in need of the structure and organization that, in principle, computational neuroscience could provide. What organization exists in this town is based on what part of the brain, or what type of organism is being studied, with the poster characterizing the different scientific cultures in each case. Thus, on the left, the "United Cerebral Evangelical Fellowship" is advertising a sermon titled "Oscillations to Higher Consciousness", while local maps can be obtained at the Hotel Hippocampus. The Crunchies and Squishies General Store is a fairly collegial happy place with lots of odd creatures hanging around, whereas next door, there is an all out fist fight raging at the Cerebellar Bar. At the end of the street are two banks: the Bank of NIMH, large and quite prosperous, and the Bank of NSF, quite a bit more modest. At this early stage of the computational neuroscience invasion, the few townspeople paying any attention seem either dubious or actively resistant.

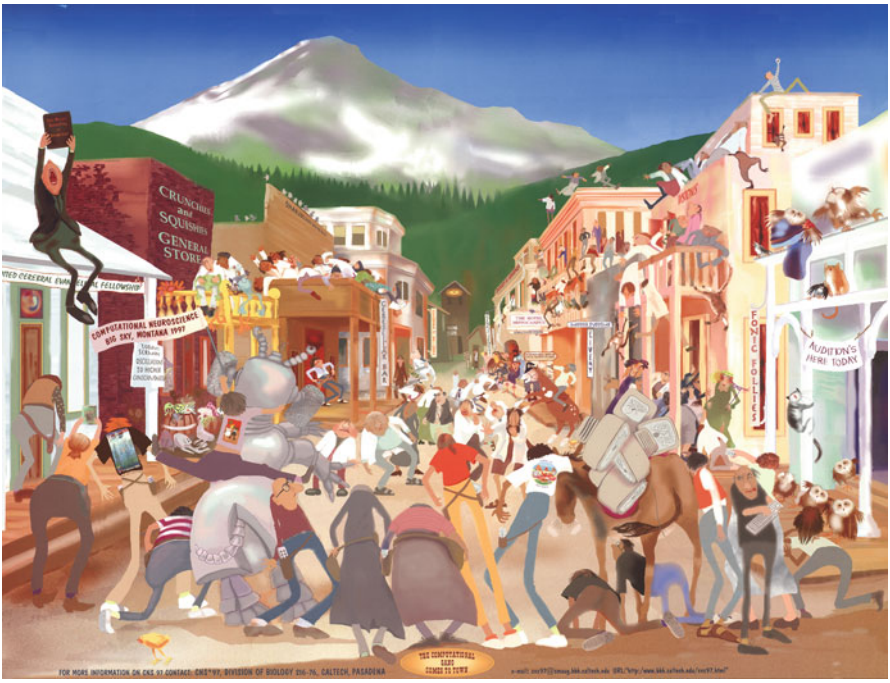

Fig. 2.7 The Wild Wild West

Fig. 2.8 Not IACUC approved

The poster for CNS*98 held in Santa Barbara, CA, is the design that has apparently produced the most consternation and speculation regarding who is being represented doing what (Fig. 2.9). In 1998, "Santa Barbara" was one of the more famous US-produced daytime soap operas around the world. In fact, the Santa Barbara script

Fig. 2.9 Such a tangled web we weave

in the poster is taken directly from the trademark for that soap opera. Of course in Southern California, the city of Santa Barbara is also generally associated with a soap opera-like culture. Accordingly, this seemed a wonderful opportunity to illustrate the more "soap opera-like" features of computational neuroscience.

Over many years, I have heard numerous speculations regarding who is represented in the poster (as one would expect from a soap opera) but, in fact, only four figures are based on actual individuals. The figure on the left (with a nametag) commemorates the winner of the official tequila drink off (and the first runner up in the barrel races) at CNS*97 in Montana. Despite this fact, I understand this poster is hanging in the halls at NIH. The women playing catch-up behind him was the principle competitor in the actual tequila drink off, even though she was at a decided handicap having spent the entire previous evening in Montana playing drums for Ramon and the K-halls while standing up. Then there is a somewhat unseemly transaction going on at a table in the back between someone dressed in a naval uniform and someone being asked to sign a contract in exchange for cash. The naval officer actually represents a real program officer at the Office of Naval Research who several years earlier had cut grant funding for the CNS meetings because the meeting's participants had voted down his proposal to merge with a neural networks meeting. In this poster, for the first time, I included myself—I am riding the horse. But the computational neuroscientist drowning himself in the center of the poster was intended to more generally represent the plight of modelers trying to publish

Fig. 2.10 Visions of the future

their results. Specifically, he is clutching a rejection letter from Science Magazine, which had recently introduced a new process to "reject without review" papers judged by a small group of senior editors to be less interesting than other papers submitted during the same week. In my view this introduced a new and unfortunate level of scientific politics more appropriate to a soap opera.

The poster for CNS*99 commemorates both the city of Pittsburgh and the increasing growth in papers submitted to the meeting describing molecular and cellular level modeling (Fig. 2.10). As a welcoming gesture, the poster reflects not only

Fig. 2.11 It's only rock and roll …

Pittsburgh's famous history as a steel town but also what seemed to me to be the more industrial nature of many molecular and cellular research efforts. Produced by a cloning machine on the second floor, the basement is filled with graduate students laboring with pipet men in individual cubicles collectively producing a delicate thread of DNA. That DNA first winds through a huddle of postdoctoral fellows trying to make sense of the sequence by hand, before ascending to the head of the laboratory, who sits converting the DNA into cash. While perhaps a bit dark, there is hope in the form of a group of computational biologists breaking into the building from above. They have actually divided into two groups, one with decidedly greedy expressions headed straight for the head of the laboratory (and the cash), and the other parachuting from a loftier height on the way to the postdocs doing the analysis. I would note that nobody is heading to liberate the poor basement dwelling graduate students. To my amazement, I have seen this poster on the wall in many molecular biology laboratories. Of course, the CNS meeting has always warmly welcomed molecular and cellular experimentalists as well as theorists. "The photograph from CNS*99 shown in Fig. 2.11, commemorates another performance by Ramon and the K-halls, this time in a "Pittsburgh appropriate" bar discovered by a dedicated group of local CNS graduate students.

The new millennium meeting in Brugge, Belgium, represented an important step for the CNS meetings, as it was the first meeting held outside the United States. Today, the meeting alternates between the United States and a foreign site, but CNS 2000 was our first trip to Europe. It seemed fitting, therefore, to represent this important step as yet another invasion, this time backwards from the new world to the old (Fig. 2.12). Thus, the Santa Maria can be seen unloading computational neurobiologists (as well as computers, and *Rattus norvegicus*) to a decidedly old masters version of Belgium. Greeting the arriving hoard at the doc is one Erik De Schutter, dressed in a green hoody and standing in front of the conference flag. It is clear that the Europeans, in general, are not quite sure what to make of the scene. The Nina, the next ship to be unloaded, is carrying "Ramon and the K-halls" for

Fig. 2.12 Re-migration

their upcoming performance at a Celtic Bar in Brugge (Fig. 2.13). Unfortunately, an effort to quickly make a Stonehenge pillar for that performance was thwarted because the artist thought that I had mistakenly specified the pillar in inches rather than feet. This poster was the last drawn by Erika Oller, as her growing independent art career left her little time for such frivolities.

In addition to the artist transition to Bonnie Callahan, CNS 2001 also represented a transition for me as I had decided, after 10 years, to resign as meeting chairman. It was at this meeting that the initial steps to form the Organization for Computational Neuroscience (OCNS) were initiated as a way to continue the meeting as well as provide more general support for the field of computational neuroscience. Because CNS 2001 was also the meeting's 10th anniversary, I wanted to use the poster to commemorate the many individuals who had played an important role in the meeting's growth and also to reflect the meeting's fun/festival/summer camp-like culture they had helped to establish (Fig. 2.14). Asylomar on the California coast was the ideal venue.

In this poster, for the first time, everybody is somebody. This poster also includes more inside information than any poster in the series, most of which, to protect the guilty and the innocent, I won't go into. There are, however, several individuals and circumstances worth noting: First, this poster specifically includes a performance by Ramon and the K-halls now named simply "the K-halls," as Ramon has left the band (note the free standing microphone and the fellow slipping away in the distance carrying his cowboy boots). Second, the occupants of the deck on the right are all important figures in guiding and growing the CNS meeting. Especially worth

Fig. 2.13 Druids all

Fig. 2.14 Summer camp

Fig. 2.15 A tribute

noting are the meeting's cofounder John Miller (wearing his unibomber outfit), our Federal Government Liaisons Dennis Glanzman and Yuan Liu (who also wrote the introduction to this book), and Ranu Jung, who played a particularly important role in the birth of OCNS. A few other individuals scattered about are Bill Bialek (sage-like), Eve Marder (famous for mentoring her graduate students), Erik De Schutter (proud to be a member of the EU and also subsequently central to the growth and success of OCNS), and Valentino Braitenburg who only attended one CNS meeting (in Montana) but astonished everyone by not leaving the dance floor while the K-halls performed (for four hours). Dancing near Valentino is David Nicoladie Tam who is the only scientist to have attended every CNS meeting for the last 22 years, and Dave Beeman and his wife, once again reliving the 60s. Of particular importance is Judy Macias, dancing and holding the tambourine, who, as the conference secretary, was the heart and soul of the meeting for many years. This poster also includes, for the second time, Christof Koch, standing behind the fence along with several other prominent computational neuroscientists (behind the hedge) who for one reason or another had not yet attended a CNS meeting. Finally, behind this group is someone hanging from a gallows. I have heard many amusing speculations as to who that person might be, but, it turns out that Bonnie Callahan (the artist) snuck the image in at the last minute to represent what might happen to her if all the stories buried in this poster were brought to light. No risk there.

The new CNS meeting chair for 2002 was the Phil Ulinski aided by his lovely wife Mary (Fig. 2.15). For the first time in 10 years my only responsibility was for the poster and a not very inspiring K-Halls unplugged acoustic guitar session. Given that Chicago was at that time world famous for the Chicago Bulls, it seemed reasonable to use a basketball motif for the meeting (Fig. 2.16). Interestingly enough, the depicted basketball game has often been misinterpreted as a contest

Fig. 2.16 Michael with the ball

between real neurons and neuronal models. In fact, my intention was a competition between more abstract models and those based on actual neuronal morphology. In this case, no doubt reflecting my own scientific biases, the biologically realistic models are ahead 69–66 and have the ball. However, storm clouds are brewing in the distance. The game is being referred by NIH and NSF and is, in fact, still on going as there is no official game clock. Phil Ulinski, who sadly passed in 2010, played an important role in the CNS meetings, the growth of computational neuroscience, and the formation of the OCNS.

The poster for CNS 2003 was the first poster that was only available in digital form (Fig. 2.17). Capitulating, the poster also included the names of the invited speakers. Because the meeting was held in Spain, I thought that it was simply too wonderful an opportunity to make a final personal statement about the nature of computational neuroscience and neuroscience as a whole. In this case, instead of windmills, Don Quixote, dressed in the official medieval academic robes of a biologist, is tilting at Purkinje cells while poor Poncho Panza (his graduate student) is trying to make sense of the data using an ever more complex set of experimental and computational tools. However, in contrast to the poster for CNS*93 designed 10 years earlier, this time the electrode being inserted into the Purkinje cell is directly connected to computational tools, and the experimentalist is technically linked to the computational neurobiologist. While this is still clearly madness, there is now hope. Figure 2.18 provides some sense of the process involved in generating the CNS poster each year.

In the years from 2003 to 2010 meetings were held, and posters were made (Fig. 2.1), however, I did not return to CNS poster design until 2010, when Charlie

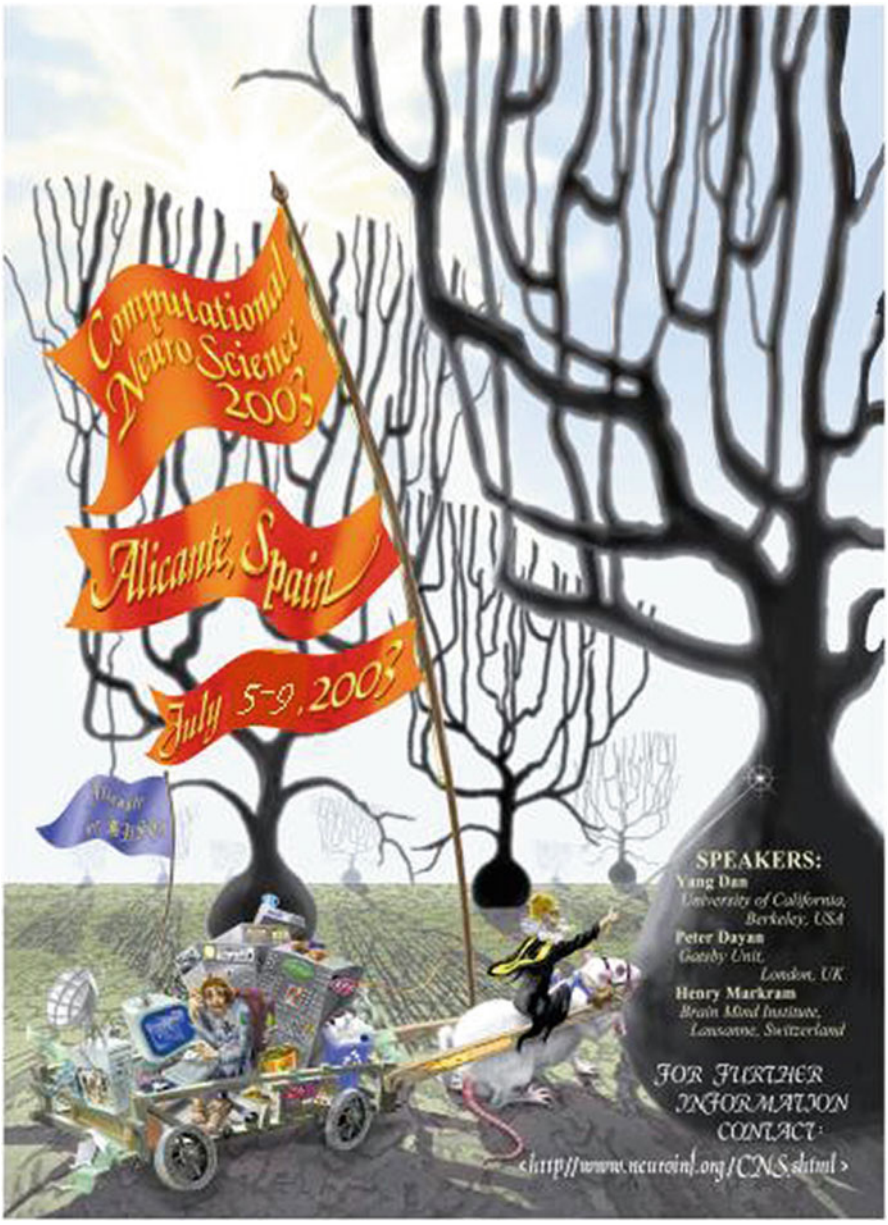

Fig. 2.17 Many knights-errant astride Ratinante

Wilson, Todd Troyer, and myself were appointed local co-organizers for the meeting in San Antonio, TX. While officially the 19th CNS meeting, the poster celebrates the full sequence of meetings, going back to its origins (Fig. 2.19). As shown, this poster was also produced in two slightly different forms, one to advertise the meeting (above) and one handed out during the meeting (below).

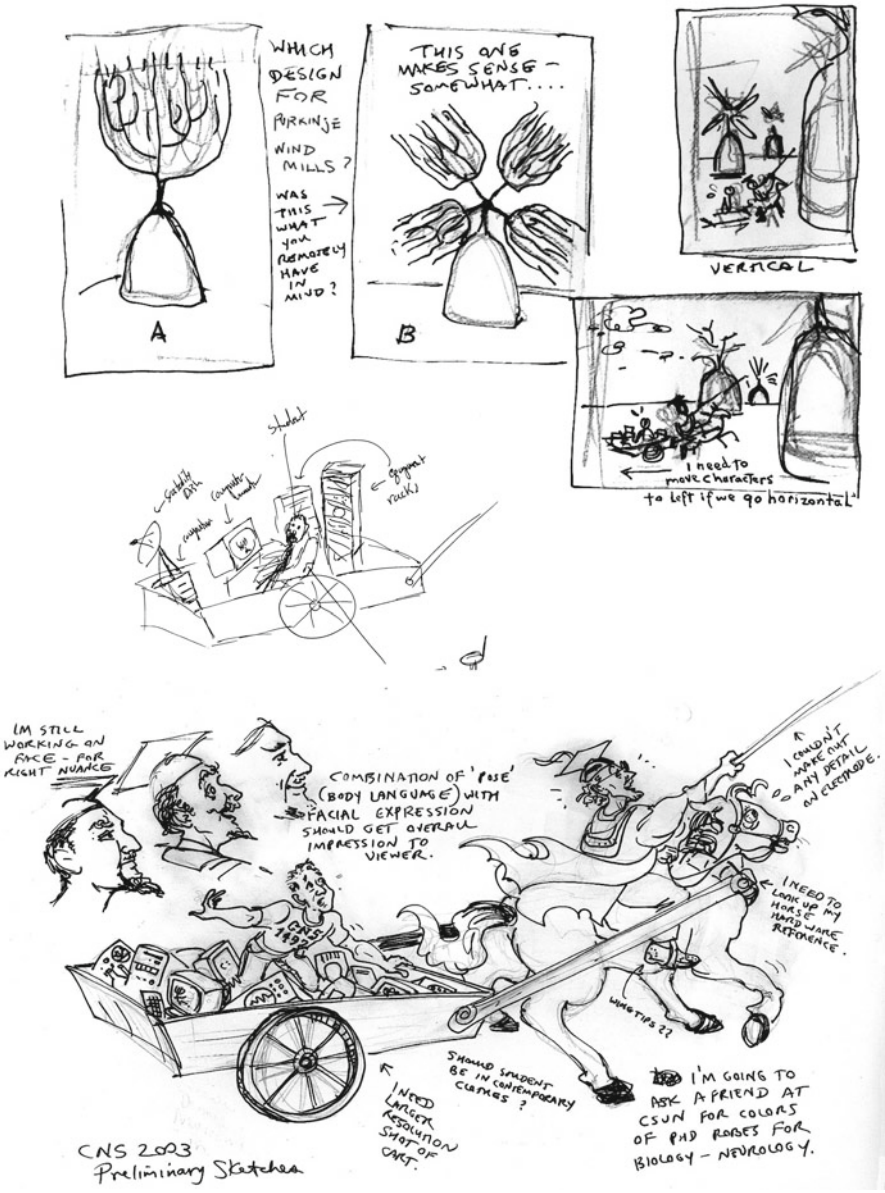

Fig. 2.18 The back and forth—creation of a CNS poster. At the top are the artist's choices for design of the central Purkinje cell in the poster for CNS 2003. In the center is the original sketch by JMB of the cart containing the long suffering graduate student. At the bottom is an early version of the cart by the artists with design notes. Iteration on poster design often continued for several months before the final version was ready for production. Artist renderings by Bonnie Calahan

Fig. 2.19 In sum and summary

The poster venue is the famous San Antonio River Walk running adjacent to the meeting site. In the pre-meeting version of the poster, the riverboat is being piloted by a somewhat shady figure, and the boat passengers (actually the OCNS organizing committee) seem clearly to be worried, this despite the fact that two additional lines are being held on the shore for stability. In the final version handed out at the meeting, the boat has moved a bit further down the river and the OCNS committee seems somewhat less concerned, perhaps because there isn't much that can be done about the situation now anyway. As with the poster for CNS*2001, all the figures represent real individuals who have played an important role in the development of the CNS meetings and computational neuroscience as a whole. Ranu Jung, at the far head of the boat before the meeting, is seen leaping out in the second poster, as she transitioned after a number of years as OCNS president. Erik De Schutter is seen climbing on, unaware that he would soon be arrested at the CNS banquet.

Fig. 2.20 The hall of fame and shame at CNS 2010

On the banks of the river, as on the San Antonio River Walk, are clubs, restaurants, and other establishments in this case representing the 18 previous CNS meetings. In the far distance, the river bifurcates at the eternal Purkinje cell into two streams, each presenting the meetings from which the original CNS meeting evolved. One stream represents the early Berkeley workshops organized by John Miller and colleagues (John standing on the bridge), and the other representing the original Neural Information Processing (NIPS) meetings. Old style signs made from the meetings' posters hang from each establishment commemorated 20+ years of meetings. From neurobiologists populating the dendrite of a Purkinje cell, to the complex serenity of a kelp forest, to the tangled complexity of Boston, to the wild west, to a return trip to the old country, and a summer camp in Asylomar, this final poster, for me, represents the process involved in the emergence of computational neuroscience as a stable, organized, and sophisticated science, as well as a certain wistfulness about its more playful and less certain past. Figure 2.20 shows the "walk down memory lane" at CNS 2010. Here is to another 20 years of CNS meetings.