**Table S1. Summary of small animal awake fMRI since the year 2000**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ref.** | **Scanner** | **Species** | **Anesthetics** | **Training** | **Setups** | **Ear/Bite bar** | **Stress monitor** | **Motion detection** | **Stimulus** |
| (Gutierrez-Barragan et al. 2022) | 7.0T Scanner,  Anat. Image: 0.23×0.23×0.6mm  EPI image: 0.23×0.23×0.6mm | C57BL/6J mice  10 male | None | 4weeks, Day1-3, 10-15min handling, day4, 10min cradle exploration,  Day5, 10min head fixation. Day8-26, mock scanner training, 8min up to 32min | Headpost,  Body and tail were taped to the cradle arc.  Cotton rolls were placed to reduce jaw and forepaw movement. | Unknown | Corticosterone | frame-wise displacements (FD) for motion evaluation | None |
| (Dinh et al., 2021) | 9.4T Scanner,  FLASH Image: 0.059×0.059×0.5mm  EPI image: 0.156×0.1456×0.5mm | C57BL/6 mice,  13 male | 1% isoflurane before training and imaging | 10days, 30min up to 120min, 15min/day increment, for remaining 3days, four mice trained in mock scanner, 3 mice trained in real scanner | Headpost,  Body/neck restrain,  nose cone | Unknown | Unknown | Respiration  Temperature  Chest movement were monitored  frame-wise displacements(FD) for motion evaluation | Visual stim |
| (Tsurugizawa et al., 2020) | 4.7T Scanner,  Anat. Image:  0.125×0.125×1.0mm  EPI Image:  0.2×0.2×1.0mm | 15q dup mice, 25 mice were used for fMRI(including 10 wide type for control ) | 2% isoflurane before training and imaging | 4days, 2 days outside scanner, 2 days inside scanner. 30min at 1st and 60min at 2nd. | Headpost  nose mask  ear bar | Ear bar | Corticosterone | Heart rate respiration rate  Six motion parameters (three translation and three rotation) | Ofaction stim |
| (Chen et al., 2020) | 9.4T Scanner,  RARE Image: 0.0625×0.0625×0.4mm  EPI Image: 0.15×0.15×0.4mm  0.1×0.1×0.3mm  0.2×0.2×0.3/0.4mm | C57BL/6 mice  40 male | Unknown | 7days, day1-day4 head fixed with noise,  Day5-day7 with sensory stimulus | Head holder  Kwil-cast  Earphone tube | Ear is fill with the silicone | Unknown | respiratory ate | Whisker auditory  olfactory |
| (Behroozi et al., 2020) | 7.0T Scanner,  RARE Image:  0.23×0.23×0.25mm | Pigeons  Twenty adult Columba livia | Unknown | 3weeks,  10min up to 100 min.  Water deprivation for the whole night before the imaging | plastic pedestal,  head screws,  piezo-electric pressure sensors measuring the dynamic pressure of jaw movements | Unknown | Corticosterone  (ACTH stimulation test) | Respiration rate  heart rate | Color discrimination for Go/no Go task |
| (Desjardins et al., 2019) | 7.0T Scanner,  RARE Image:  0.078×0.039×1.0mm  EPI Image:  0.2×0.2×1.0mm | C57BL/6J, JAX014548,  JAX 005628,  JAX 024109,  16 mice | Anesthetize(<60s) for head fixation | 2 hours/day | Headpost | Ear plugs | Unknown | Camera surveillance | Whisker  optogenetic |
| (Han et al., 2019) | 9.4T Scanner,  RARE Image: 0.0625×0.0625×0.4mm  EPI Image: 0.15×0.15×0.4mm | C57BL/6J mice  8 male | Unknown | water restriction habituation, automatic lick teaching, automatic shaping, GNG task training | Head holder  Kwil-cast | The drum membrane of the middle ear was punctured quickly, and the Kwik-cast was then injected | Unknown | Unknown | olfaction stim for Go/noGO licking |
| (Matsubayashi et al., 2018) | 7.0T Scanner;  RARE Image:  0.075×0.075×0.3mm,  EPI Image:  0.2×0.2×0.5mm | C57BL/6J mice  9 female | Unknown | 5 weeks,2 hours/day, mice underwent laminectomy at the level of the Th9/10 vertebra | Head bar  Body restrain | Unknown | Unknown | Respiration rate | Unknown |
| (Takata et al., 2018) | 7.0 T Scanner,  RARE Image:  0.075×0.075×0.3mm,  EPI Image: 0.2×0.2×0.5mm. | Double transgenic mice  22 male  29 female | Unknown | 7 days,  2 hours/day | optical fiber head-holder | Unknown | Unknown | Unknown | Optogenetics in the left visual cortex |
| (Stenroos et al., 2018) | 7.0 T Scanner,  Anat. Image:  0.097×0.097×0.75mm,  EPI Image: 0.39×0.39×1.5mm. | rat  8 male | 1.5-2% isoflurane before training and imaging | 10 days,  15min up to 45min,  forepaws were attached with masking tape, hind paws were tied together with the tail with tape | Body restrain with cloth | bite bar  shoulder support  pad cheek support  nose cone | Corticosterone | heart rate  respiration | None |
| (Paasonen et al., 2018) | 7.0 T Scanner,  Anat. Image:  0.097×0.097×0.75mm,  EPI Image: 0.39×0.39×1.5mm. | rat  8 male | 1.5-2% isoflurane before imaging | 10 days,  15min up to 45min,  forepaws were secured and hindpaw with tail were secured using masking tape. The body was wrapped with plastic foam sheet | Body restrain with cloth | bite bar  shoulder support  pad cheek support  nose cone  Silicone plugs were inserted into the ear | Corticosterone | Unknown | None |
| (Matsubayashi et al., 2018) | 7.0T Scanner,  RARE Image: 0.075×0.075×0.3mm, EPI Image:  0.2×0.2×0.5mm. | C57BL/6J mice  spinal cord injury  9 female | Unknown | 1 week, 2hurs/day | head-bar | Unknown | Unknown | respiration | None |
| (Ma et al., 2018) | 7.0T Scanner,  Anat. Image: 0.125×0.125×1.0mm, EPI Image:  0.5×0.5×1.0mm. | rat  59 male | 3% isoflurane before imaging | 7 days | bite bar, ears secured by two adjustable ear pads, and nose secured by a nose bar,  head restrainer | Bite bar  Ear bar  Nose bar | Unknown | translational movement | None |
| (Smith et al., 2017) | 4.7 T Scanner,  RARE Image:  0.125×0.125×1.0mm,  EPI Image: 0.5×0.5×1.0mm. | Long Evan rats  42 male | 2% isoflurane before training and imaging | 7days | Headpost,  Body restrain | Unknown | Unknown | Unknown | Nome |
| (Madularu et al., 2017) | 7.0T Scanner,  RARE Image: 0.3×0.3×1.2mm,  Func. Image:  0.3×0.3×1.2mm. | C57BL/6 mice  33 male | 2% isoflurane before training and imaging | 5 days | No headpost, 3D printed restrain system. | Unknown | Respiration rate, Fecal boli | Volume displacement | olfactory stimulus |
| (Chang et al., 2017) | 7.0 Scanner,  Anat. Image:  0.38×0.38×0.5mm,  EPI Image:  0.38×0.38×0.5mm. | rats  22 male | Unknown | 2 weeks, 30mins/day | Head-Post | Unknown | No | respiratory rates | air-puff stimuli to the side surface of their hind paw |
| (Poirier et al., 2017) | 4.7 scanner,  RARE image:  0.125×0.125×1.0mm, EPI image:  0.5×0.5×1.0mm. | adolescent spontaneously hypertensive rat(n=26),  Wistar Kyoto(n=20) and Sprague–Dawley(n=12) | 1% isoflurane before training and imaging | 8 days, 15mins up to 90min, 15 min/day increment | No headpost  head restrainer  body tube | Ear bar  nose clamp | Unknown | Unknown | None |
| (Van Ruijssevelt et al., 2017) | 7.0T Scanner,  EPI Image:  0.25×0.25×0.75mm, RARE Image:  0.07×0.07×0.07mm. | zebra finches  10 male | Unknown | 25days,  10min up to120min | Head fixed,  Body jacket, beak mask and fixation tape. | Unknown | Unknown | Respiration rate | Auditory Stimulus |
| (Berns et al., 2017) | 3.0T Scanner,  Anat. Image:  3.0×3.0×2.5mm,  Func. Image:  3.0×3.0×2.5mm. | Dog  43 both male and female | Unknown | 2 months,  10-15min/day, three days/week, | Unknown | Unknown | Unknown | Unknown | hand signals indicating |
| (Behroozi et al., 2017) | 7.0T Scanner,  EPI Image:  0.15×0.15×0.3mm, RARE Image:  0.47×0.47×1.0mm. | Pigeon  8 Valencian Figurita | Unknown | 10days,  15min up to 60min | plastic pedestal | Unknown | Unknown | Respiration rate | no |
| (Yee et al., 2016) | 7.0T Scanner,  RARE Image:  0.097×0.097×0.7mm  EPI Image:  0.26×0.26×0.7mm | prairie voles  14 male | Unknown | no training procedures,  only restrain in the scanner | Body restrain and nose cone, bite bar, helmet | Bite bar | Unknown | Heart rate | CO2 (5%)  odor |
| (Moore et al., 2016) | 7.0T Scanner,  RARE Image:  0.097×0.097×0.75mm,  EPI Image:  0.26×0.26×0.75mm. | Male Oprm1+/+ and Oprm1−/− mice | 2-3% isoflurane before training and imaging | 4 consecutive days, 30min/day | head in a cushion, ear bars, pressure points used to immobilize the head | Ear bar | Unknown | Unknown | 5% carbon dioxide |
| (Madularu et al., 2016) | 7.0T Scanner,  RARE Image:  0.11×0.11×0.75mm  EPI Image:  0.3125×0.3125×0.75mm | OVX Sprague Dawley  36 rats | 2-3% Isoflurane  before training and imaging | 5 consecutive days, 30mins/day | head in a cushion,  pressure points used to immobilize the head, ear bars, | Ear bar | Unknown | Unknown | None |
| (Kenkel et al., 2016) | 7.0T Scanner,  RARE Image:  0.11×0.11×1.0mm,  EPI Image:  0.3125×0.3125×1.0mm | Adult WT (12) and Fox (10) male Sprague Dawley rats | 2-3% Isoflurane  before training and imaging | 4-5 consecutive days, 30mins/day | Head holder and body tube, no headpost, ear bars, body, paws were tighten in the scanner. | Ear bar | Unknown | Unknown | Odor stimulus |
| (Chang et al., 2016) | 7.0T Scanner,  EPI Image:  0.38×0.38×0.5mm | Sprague-Dawley rats,  10 male | Unknown | 8-10 days, (30min/day) | Headpost,  body restrain | Unknown | corticosterone | Respiration rate | Air-puff to the forepaw |
| (Yoshida et al., 2016) | 7.0T Scanner,  EPI Image:  0.2×0.2×0.5mm | C57BL/6 mice,  8 male | Unknown | 8 days,  2 hours/day | head bar  EMG electrodes | Unknown | ECG  EMG | Heart rate | None |
| (Aksenov et al., 2016) | 9.4T Scanner,  EPI Image:  0.375×0.375×1.0mm | Dutch-belted rabbit  6 female | Unknown | 3-5day, restrained by means of a cloth sleeve | headbolts, electrodes and cannulae were implanted | Unknown | LFP  MUA | Unknown | Optogenetic  Whisker stimulus |
| (Madularu et al., 2015) | 7.0T Scanner,  RARE Image:  0.11×0.11×1.0mm  EPI Image:  0.3125×0.3125×1.0mm | OVX Sprague Dawley rats  27 female | 2-3% Isoflurane  before training and imaging | 5 consecutive days, 30mins/day | head in a cushion  ear bars, pressure points used to immobilize the head | Ear bar | Unknown | Unknown | drug model |
| (Liang et al., 2015b) | 7 T Scanner,  RARE Image:  0.125×0.125×1.0mm  EPI Image:  0.5×0.5×1.0mm | 11 rats | 2% Isoflurane  before training and imaging | 7 days ,  15min up to 90min | four plastic MR compatible screws were fixed into the skull, optic fiber was embedded | Ear bar | Unknown | Unknown | Optogenetics |
| (Liang et al., 2015a) | 4.7 T Scanner,  RARE Image:  0.125×0.125×1.0mm  EPI Image:  0.5×0.5×1.0mm | Long Evan (LE) rats  42 male | 2% Isoflurane  before training and imaging | 7 days,  15min up to 90min | Plexiglas stereotaxic head holder, plastic ear bars, forepaw and hindpaw were loosely taped | Ear bar | Unknown | Unknown | None |
| (Harris et al., 2015) | 7.0 T Scanner,  RARE Image:  0.1×0.1×0.8mm  EPI Image:  0.3×0.3×0.8mm | C57bl/6 mice  44 male | 1–2% Isoflurane  before training and imaging | 5 days, 22min/day,  12-day protocol  6 min up to 22 min | No headpost, limbs were tapped, body were restrained in the body restrainer, nose cone, foam headband | Foam headband into the ear | respiration rate, heart rate,  body movements e.g. leg kicks, arched back)  body weight, Corticosterone | Respiration,  Heart rate,  Body weight,  Body movements,  Corticosterone, | cued fear conditioning Foot shock(0.5mA) |
| (Dilks et al., 2015) | 3.0T Scanner,  Anat. Image:  1.5×1.5×2.0mm,  EPI Image:  3.0×3.0×3.0mm. | 8 Dogs | None | 2-3 months, presentation of images on a computer screen | Unknown | Unknown | Unknown | Unknown | Face processing |
| (Liang et al., 2014) | 4.7 T Scanner,  RARE Image:  0.125×0.125×1.0mm  EPI Image:  0.5×0.5×1.0mm | Long-Evans (LE) adult rats  32 male | 2% Isoflurane  before training and imaging | 7 days,  15min up to 90min | Plexiglas stereotaxic head holder  plastic ear bars, forepaw and hindpaw were loosely taped | Ear bar  Bit bar | anxiety level of rats was assessed by using the EPM test | EPM test | None |
| (Ferris et al., 2014) | 7.0 T Scanner,  RARE Image:  0.097×0.097×0.75mm,  EPI Image:  0.26×0.26×0.75mm. | Wild-type mice (C57B/L6J) (n =5 male, 6 female) and knock in zQ175 HET (n =4 male, 6 female) and HOM (n =5 male, 5 female) mice | 2-3% Isoflurane  before training and imaging | 4 consecutive days, 30min/day | Body tube,  nose cone,  hollow tube | Bite bar | Unknown | displacement | Odor stimulus |
| (Ma et al., 2013) | 3.0 T Scanner,  RARE Image:  0.5×1.0×0.5mm,  EPI Image:  2.0×2.0×2.0mm. | 4 cats | Unknown | Unknown | head-post,  animal chair, | Unknown | Unknown | displacement | Visual stimulus |
| (Johnson et al., 2013) | 7.0 T Scanner,  Anat. Image:  0.11×0.11×1.0mm,  Func. Image:  0.46×0.46×1.0mm. | Sprague–Dawley rats  9 male | Unknown | 10 days cocaine + odor versus no cocaine + no odor training | Chamber,  Electrode,  intravenous catheters, | Unknown | Unknown | Unknown | cocaine-associated odor cue |
| (De Groof et al., 2013) | 7.0 T Scanner,  Anat. Image:  0.085×0.085×0.17mm,  Func. Image:  0.34×0.34×1.0mm. | Pigeons  4 adult | None | three distinct procedures: a)10-30-60min for 3days, b)head fixed 10-20-40min,c) with sounds for 1 week | Cloth jacket, head pedestal; plastic tube; | Unknown | Unknown | displacement | Visual stimuli |
| (Berns et al., 2013) | 3.0 T Scanner,  Anat. Image:  1.5×1.5×2.0mm,  Func. Image:  3.0×3.0×3.0mm. | 15 dogs | None | 2-3months | chin rest, neck coil | Unknown | Unknown | Unknown | Hand signals |
| (Tsurugizawa et al., 2012) | 4.7 T Scanner,  Anat. Image:  0.54×0.54×1.3mm,  Func. Image:  0.27×0.27×1.3mm. | Wistar rats  12 male | 2% isoflurane | 3 days, 30-90min | Body restraint,  head positioner  elastic bands | earplugs | Heart rate respiration rate | Unknown | light stimulation |
| (Desai et al., 2011) | 9.4 T Scanner,  Anat. Image:  0.78×0.78×0.5mm,  Func. Image:  0.1×0.1×0.5mm,  0.2×0.2×0.5mm. | 11 wild-type,  11 transgenic ChR2 mice | 0.7% isoflurane for awake imaging | 3 days, 20-40mins | Headpost, body restraint tube | Unknown | respiration rate | respiration  displacement | optogenetics |
| (Liang et al., 2011) | 4.7 T Scanner,  Anat. Image:  0.125×0.125×1.0mm,  Func. Image:  0.5×0.5×1.0mm. | Long–Evans rat  16 adult male | isoflurane | 8days, 15-90mins | head holder using plastic ear-bars | Ear bar  Bite bar | Unknown | Unknown | None |
| (Zhang et al., 2010) | 4.7T Scanner,  RARE Image:  0.125×0.125×1.0mm,  EPI Image:  0.5×0.5×1.0mm. | Long-Evans (LE) rat  8 adult male | 2% Isoflurane  before training and imaging | 8day,  15min up to 90min | Plexiglas stereotaxic head holder  plastic ear bars, forepaw and hindpaw were loosely taped | Ear bar | Unknown | Unknown | None |
| (Chen et al., 2009) | 4.7T Scanner,  RARE Image:  0.117×0.117×1.0mm,  EPI Image:  0.468×0.468×1.0mm. | 8 female rats | 2% Isoflurane | 3day | Restrainer, headpiece, ear bar, head holder, bite bar, body tube | Ear bar  Bite bar | None | None | water (no odor), lemon scent, and TMT odor |
| (Febo et al., 2008) | 4.7T Scanner,  RARE Image:  0.117×0.117×1.2mm,  EPI Image:  0.468×0.468×1.2mm. | Virgin Sprague-Dawley rats | 2-3% isoflurane | 4day,  90min/session | Headpiece, head holder, Bite bar, ear bar, | Ear bar  Bite bar | None | None | Pup Suckling |
| (Ferris et al., 2008) | 4.7T Scanner,  RARE Image:  0.117×0.117×1.2mm,  EPI Image:  0.468×0.468×1.2mm. | Adult male and female Long-Evans rats | 2–3% isoflurane | 4day,  60min/session | Headpiece, head holder, Bite bar, ear bar, | Ear bar | None | displacement | Drug (SRX251 or fluoxetine) |
| (Duong, 2007) | 4.7T Scanner,  RARE Image:  0.156×0.156×1.5mm,  EPI Image:  0.3125×0.3125×1.5mm. | 7 Sprague–Daley rats | 2% isoflurane | Unknown | restrained with ear-, nose-, tooth-, and shoulder-bars, and a body restraining tub | restrainer with ear-, nose-, tooth-, and shoulder-bars, and a body restraining tub | Respiration rate  Heart rate  blood pressure | Respiration rate  Heart rate  blood pressure | Hypoxia |
| (Chin et al., 2006) | 4.7T Scanner,  Anat. Image:  0.156×0.156×1.25mm,  Func. Image:  0.156×0.156×1.25mm. | Adult male Sprague-Dawley rats | ~3% isoflurane | 4day,  7min up to 60min | Training holder, body tube and headpiece | Unknown | None | None | pharmacological (apomorphine and ABT-594) |
| (King et al., 2005) | 4.7T Scanner,  RARE Image:  0.1×0.1×1.5mm,  EPI Image:  0.2×0.2×1.5mm. | Sprague–Dawley rats  8 male | ketamine and medetomidine being secured | 8 consecutive days, 90min/session | headpiece with blunted ear,  bite bar,  body tube | headpiece with blunted ear,  bite bar,  body tube | respiratory rate and heart rate  corticosterone | corticosterone | None |
| (Febo et al., 2004) | 4.7T Scanner,  Anat. Image:  0.117×0.117×1.2mm,  EPI Image:  0.468×0.468×1.2mm. | Male Sprague-Dawley rats | 2% isoflurane | 3-4 days,  90mins/session | cylindrical head holder, body holder,headpiece, bite bar, ear bar | headpiece, bite bar, ear bar | None | None | cocaine |
| (Sachdev et al., 2003) | 4.7T Scanner,  Anat. Image:  0.23×0.23×1.2mm,  EPI Image:  0.47×0.47×1.2mm. | Long Evans rats  3 male and 2female | Diazepam injection | Body trainer every day for 1 week. after headpost surgery, re-trained for 1 week | felt sleeve, wrapped in a cotton cloth, inserted to the neck into a Plexiglas tube;  Velcro straps | three thread-bearing nylon posts;  lightweight masking tape;  plastic pipe | Unknown | displacement | Whisker stimulus |
| (Kenneth Sicard, 2003) | 4.7T Scanner,  Anat. Image:  0.097×0.097×1.5mm,  EPI Image:  0.039×0.039×1.5mm. | Sprague Dawley rats  15 | 2% isoflurane | None | Secured in a rat restrainer with ear-, nose-, tooth-, and shoulder-bars, a body-restraint tube | Ear bar | blood pressure, heart rate, respiration rate |  | Hypercapnic (CO2) challenges |
| (Peeters et al., 2001) | 7.0T Scanner,  Anat. Image:  0.078×0.156×1.0mm,  EPI Image:  0.156×0.312×1.0mm. | 6 Wistar rats | 5% fluothane,  Atropine injection,  Mivacurium or α-chloralose | None | plexi stereotactic head holder, incisor bar and earplugs | earplugs | None | EEG recording | Electrical forepaw stimulation |
| (Wyrwicz et al., 2000) | 4.7T Scanner,  Anat. Image:  0.156×0.156×2.0mm,  EPI Image:  0.935×0.935×2.0mm. | rabbits (New Zealand white (NZW) or Dutch Belted (DB))  5 female | Unknown | 30min/sessions  1 or 2 sessions | Tied at the neck and tail in soft cloth bag and fastened to an acrylic cradle with velcro straps with four restraining headbolts. | None | None | None | Visual stimulation |

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