

## 第 64 章 大脑老化

如图 64.0.1 所示，在 1900 年，美国的平均寿命约为 50 岁。到 2015 年，男性约为 77 岁，女性约为 82 岁。其他 30 个国家的平均水平更高。这些增加主要是由于婴儿死亡率的降低、疫苗和抗生素的开发、更好的营养、改进的公共卫生措施以及心脏病和中风的治疗和预防方面的进步。由于预期寿命的延长，以及二战后不久出生的大批“婴儿潮一代”，老年人成为美国人口中增长最快的部分。



图 64.0.1：人类的寿命正在增加。在过去的 100 年里，美国人的平均寿命增长迅速<sup>[580-581]</sup>。

寿命延长是一把双刃剑，因为与年龄相关的认知改变越来越普遍。变化的程度因人而异。对于许多人来说，这些改变是温和的，对生活质量的影响相对较小，我们戏称这些短暂的失误称为“老年时刻”。其他认知障碍虽然不会使人虚弱，但足以阻碍我们独立管理生活的能力。然而，痴呆症会侵蚀记忆和推理并改变人格。其中，阿尔茨海默病最为普遍。

随着人口老龄化，神经科学家、神经学家和心理学家开始投入更多精力来了解大脑中与年龄相关的变化。主要动机是寻找阿尔茨海默病和其他痴呆症的治疗方法，但了解认知能力随年龄下降的正常过程也很重要。毕竟，年龄是各种神经退行性疾病的最大危险因素。了解随着年龄的增长我们的大脑会发生什么，不仅可以改善普通人群的生活质量，还可以提供最终帮助我们克服看似无关的病理变化线索。

考虑到这一点，我们在本章开始考虑大脑的正常老化。然后我们转向广泛的认知病理变化，最后关注阿尔茨海默病。

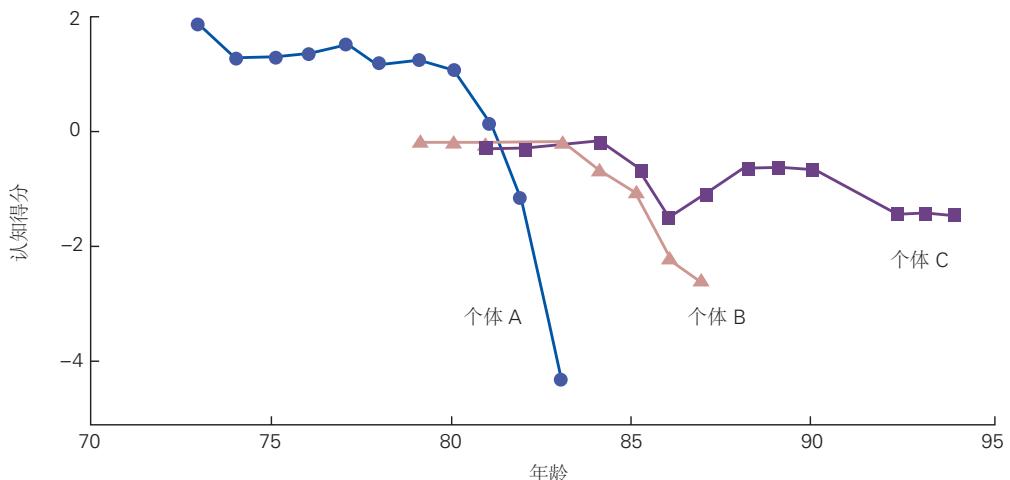
### 64.1 大脑的结构和功能随年龄变化

随着年龄的增长，我们的身体会发生变化：头发变薄，皮肤起皱，关节吱吱作响。因此，我们的大脑也会发生变化也就不足为奇了。事实上，随着年龄的增长而发生的广泛行为改变是神经系统潜在改变的迹象。例如，随着运动技能的下降，姿势变得不那么直立，步态变慢，步幅变短，姿势反射常常变得迟钝。尽管肌肉变弱并且

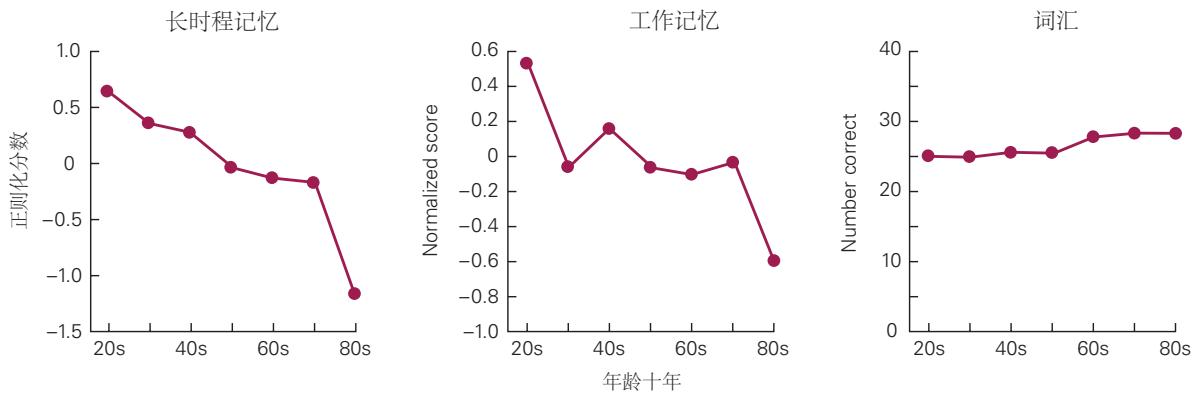
骨骼变得更脆，但这些运动异常在很大程度上由涉及周围神经系统和中枢神经系统的微妙过程引起。睡眠模式也会随着年龄的增长而改变；老年人睡得更少，醒得更频繁。归因于前脑的心理功能（例如记忆力和解决问题的能力）也会下降。

如图 64.1.1A 所示，与年龄相关的心智能力下降在速度和严重程度上变化很大。虽然大多数人的思维敏捷度会逐渐下降，但对某些人来说，下降速度很快，而其他人则终生保持认知能力，朱塞佩·威尔第、埃莉诺·罗斯福和巴勃罗·毕加索就是后一类的著名例子。提香在他 80 多岁时继续创作杰作，据说索福克勒斯在他 92 岁时创作了《俄狄浦斯在科罗诺斯》。心理功能完好保存的老年人很少见，这表明这些人的生活经历或基因可能具有特殊性质。因此，人们对研究在 10 岁甚至 11 岁时几乎保持完好认知的个体产生了极大的兴趣。这些百岁老人可能会深入了解环境或遗传因素，这些因素可以防止正常的与年龄相关的认知衰退或更具破坏性的痴呆病理下降。下面讨论的一种保护性基因变体是载脂蛋白 E 基因的 epsilon 2 等位基因。

A 个体差异性



B 任务变化



**图 64.1.1：**与年龄相关的认知衰退存在差异。A. 几十年来每年接受一系列认知测试的 3 个人的分数。人 A 迅速下降。人 B 和 C 在 80 多岁时表现出相似的认知表现，但随后出现分歧<sup>[582]</sup>。B. 对大量人进行的多项认知测试的平均分数。长期陈述性记忆和工作记忆在整个生命过程中都会下降，而且在高龄时更是如此。相反，词汇知识得以保留<sup>[583]</sup>。

如图 64.1.1B 所示，从对许多人的研究中得出的一个有趣发现：一些认知能力会随着年龄的增长而显著下降，而其他人则基本保持不变。例如，工作记忆和长期记忆、视觉空间能力（通过将积木排列到设计中或绘制三维图形来衡量）和语言流畅性（通过快速命名对象或尽可能多地命名以特定字母开头的单词来衡量）通常随着年龄的增长而下降。另一方面，词汇量、信息和理解力的衡量标准通常显示正常人在进入 80 年代后出现的轻微下降。

记忆力、运动活动、情绪、睡眠模式、食欲和神经内分泌功能的年龄相关变化是由大脑结构和功能的改变引起的。即使是最健康的 80 岁大脑看起来也不像 20 岁时那样。如图 64.1.2A 所示，老年人表现出大脑体积轻度萎缩和脑重量减轻，以及脑室扩大。从大学时代开始，大脑重量平均每年减少 0.2%，70 岁每年约减少 0.5%。

这些变化可能是由神经元死亡引起的。事实上，一些神经元会随着年龄的增长而丢失。例如，25% 或更多支配骨骼肌的运动神经元在一般健康的老年人中死亡。如图 64.1.2B 所示，正如我们将看到的，阿尔茨海默病等神经退行性疾病会显著加速神经元的死亡。然而，在健康大脑的大部分区域，仅仅因为年龄的原因，神经元损失很少甚至没有，所以大脑萎缩一定是由其他因素引起。

事实上，对人类和实验动物大脑的分析揭示了神经元和胶质细胞的结构改变。髓磷脂破碎和丢失，损害了白质的完整性。同时，皮层和其他神经元的树突状分枝密度降低，导致神经细胞收缩。合成某些神经递质（如多巴胺、去甲肾上腺素和乙酰胆碱）的酶水平会随着年龄的增长而下降，这种下降可能会导致使用这些递质的突触出现功能缺陷。如图 64.1.3 所示，突触结构也发生了改变，至少在神经肌肉接头处是这样，增加了结构变化也导致中枢突触功能缺陷的可能性。最后，如图 64.1.4 所示，新皮层和大脑许多其他区域的突触数量下降。

这些细胞变化会干扰调节我们心理活动的神经营路的完整性。与年龄相关的突触丧失以及剩余突触功能受损被认为是导致认知能力下降的重要因素。白质的变化很普遍，但在前额叶皮层和颞叶皮层尤为显著。它们可能是执行功能和集中注意力以及编码和存储记忆的能力改变的基础，这些功能位于额叶-纹状体系统和颞叶中。白质的损失也可能有助于解释最近的发现，即老年人的大脑不太能够支持通常协同工作以进行复杂心理活动的广泛分离区域的活动同步。这些大规模网络的中断可能是认知能力下降的重要原因。

长期以来，人们一直认为衰老是由于累积的遗传损伤或有毒废物导致细胞和组织逐渐退化的结果。支持这一想法的发现是，从动物身上取出并置于组织培养皿中的有丝分裂细胞在衰老和死亡之前仅分裂有限次数。如图 64.1.5 所示，这种“注定”衰老的观点在过去 10 到 20 年里发生了根本性的变化，这主要是由于在模式生物中发现了显著延长寿命的突变。

这些戏剧性的发现表明：衰老过程是在活跃的基因控制下进行的。一种已被表征的调节通路包括胰岛素和胰岛素样生长因子、它们的受体以及它们激活的信号传导程序。这些基因的破坏实际上增加了细胞对致命氧化损伤的抵抗力。人们认为，这些基因的正常形式是通过进化选择的，因为它们在生殖期对生物体有益。它们对寿命的不利影响，一旦动物过了繁殖年龄，可能是一个不幸的副作用，进化对此并不太关心。

这些发现对于理解衰老如何影响神经系统有 2 个主要意义。首先，导致或保护我们免受衰老破坏的生化机制可能是导致神经元变化的因素，这些变化又导致了与年龄相关的认知衰退。目前，正在模型生物中开展研究来探索细胞变化和认知功能之间的联系。其次，也许更令人兴奋的是，对基因研究发现途径的研究可以确定延长寿命或健康寿命（一个人保持总体健康的时期）的药理学或环境策略。

迄今为止，延长寿命（从酵母到蠕虫再到灵长类动物）的最佳验证环境策略是限制热量摄入。热量限制似乎是通过上述胰岛素通路中的基因起作用的，并且可能涉及一组称为乙酰化酶的酶。乙酰化酶被最初从红酒中分离出来的化合物白藜芦醇激活。当给小鼠服用时，白藜芦醇反过来会延缓衰老的某些方面，包括认知能力下降。虽然白藜芦醇不太可能成为人类的青春之泉，但它仍然是目前正在考虑的新化学物质的例证。这些化学策略不仅使用模式生物探索导致衰老的积极因素，而且探索阻止模式生物（可能还有人类）在其整个生命周期中保持总体健康的约束条件。

## 64.2 相当一部分老年人的认知能力下降是显著的并且使人虚弱

对于大多数人来说，与年龄相关的认知变化不会严重影响生活质量。然而，在一些老年人中，认知能力下降达到了可以被视为病态的程度。在异常范围的低端是一系列称为轻度认知损伤的变化。这种综合症的特征是记忆力减退，伴有其他认知障碍，这些障碍超出了正常衰老的范围。患有轻度认知损伤的人可能能够进行大多数日常生活活动，尽管其他人会注意到这些损伤，并且通常会影响人进行某些对他们来说重要或愉快的活动的能力，例如管理财务或玩文字游戏。

重要的是，轻度认知损伤是一种综合症，而不是一种诊断。许多潜在的问题，如抑郁症、过度用药、中风和神经退行性疾病都可能导致轻度认知损伤。如图 64.2.1 所示，大约一半的轻度认知损伤患者患有潜在的阿尔茨

A 年龄相关变化

正常 22 岁



正常 89 岁



B 阿尔茨海默病的变化

无症状 45 岁



4 年后出现行为症状



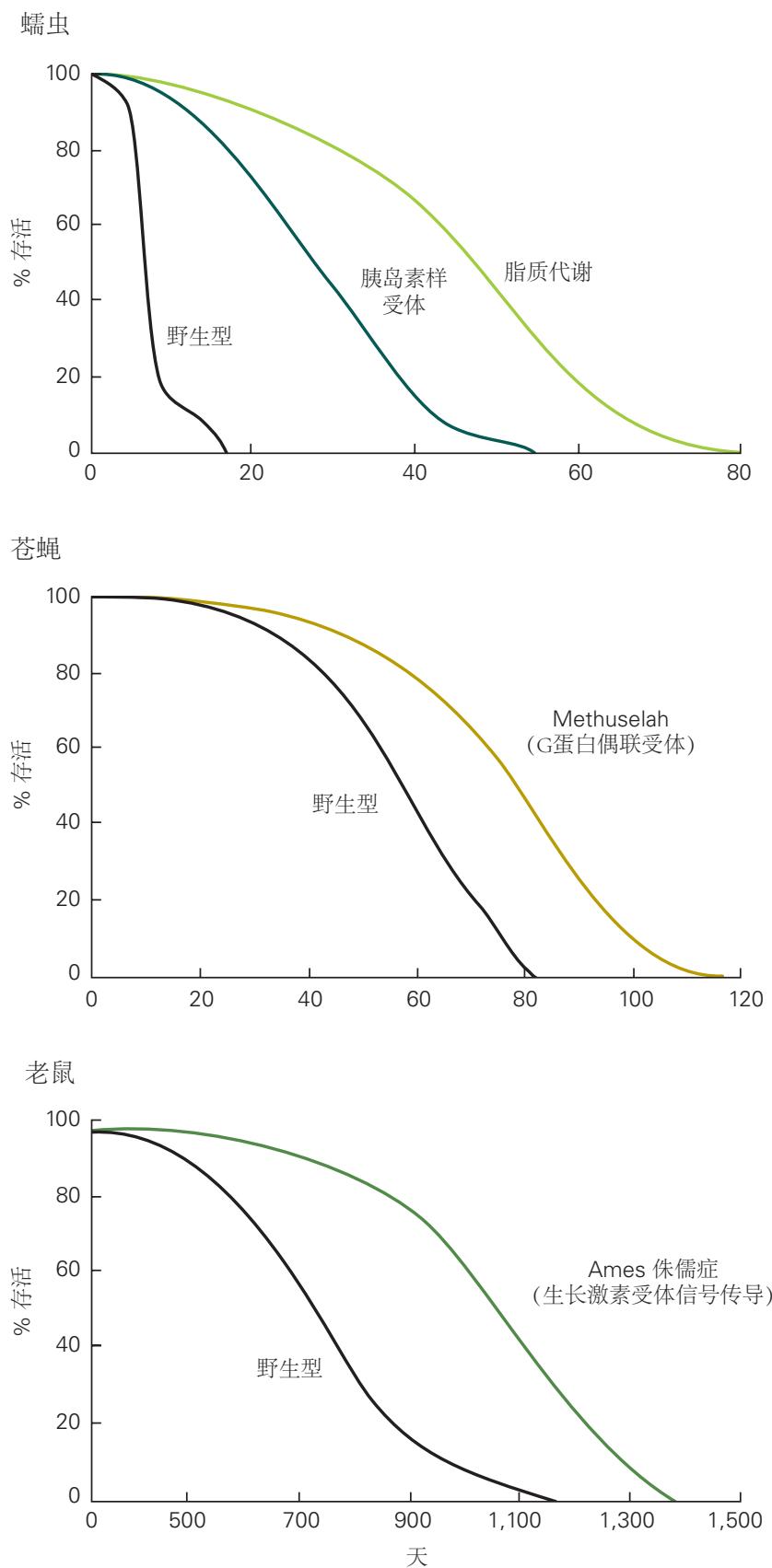
**图 64.1.2:** 随着年龄的增长和阿尔茨海默病的发作，大脑结构发生变化（另请参阅图 64.4.1）。A. 正常 22 岁和 89 岁大脑的图像揭示了活体大脑结构的变化。B. 同一个人在 4 年期间的图像显示皮层结构的逐渐收缩和心室扩大的开始（红色）。这些结构变化在行为症状出现之前就很明显。



**图 64.1.3:** 树突和突触结构与年龄相关的变化。啮齿动物的皮层锥体神经元随着年龄的增长而失去树突棘。啮齿动物的神经肌肉突触也表现出与年龄相关的结构变化。



**图 64.1.4:** 突触密度与年龄相关的变化。早期认知发展伴随着人类大脑皮层不同区域突触密度的显著增加。显示了 10 个月大的发育标志。皮层突触的密度随着年龄的增长而下降<sup>[584]</sup>。



**图 64.1.5:** 寿命可以通过基因突变来增加。特定受体和信号蛋白的基因突变显著延长了蠕虫、苍蝇和小鼠突变株的寿命，表明遗传调节机制影响衰老和寿命<sup>[585-587]</sup>。

海默病，并且该组中超过 90% 的人将在轻度认知损伤诊断后的 5 年内发展为完全痴呆。如下所述，现在有生物标志物可以提示潜在的阿尔茨海默病病理学的存在。然而，到目前为止，还没有很好的生物标志物来预测由阿尔茨海默病以外的疾病引起的轻度认知损伤患者发展为痴呆症。



**图 64.2.1:** 认知能力随年龄变化很大。该图表显示了当前对阿尔茨海默病病因的思考。这个渐进的过程是由生物、遗传、环境和生活方式因素共同作用的结果，最终使一些人走上轻度认知损伤的道路，然后是痴呆症。而其他具有不同遗传构成或一生中不同因素组合的人则继续保持健康认知老化过程（来自国家老龄化研究所）。

与轻度认知损伤一样，痴呆症也是一种涉及记忆力以及其他认知能力（如语言、问题解决、判断、计算或注意力）进行性损害的综合症。它与多种疾病有关。最常见的是阿尔茨海默病，如下所述。老年人中第二个最常见的原因是脑血管疾病，特别是导致局灶性缺血和随之而来的脑梗塞的中风。

皮层中的大损伤通常与语言障碍（失语症）、偏瘫或忽视综合症有关，具体取决于大脑的哪些部分受到损害。高血压和糖尿病也会导致白质或大脑深层结构中出现小梗塞，称为腔隙性梗塞。在少数情况下，这些梗塞可能没有症状，或者它们可能导致看似正常的与年龄相关的认知能力下降或某些轻度认知损伤病例。然而，随着血管病变数量和大小的增加，它们的影响会累积，最终会导致痴呆。

许多其他情况可导致痴呆，包括帕金森病、路易体痴呆、额颞痴呆、酒精中毒、药物中毒、艾滋病毒和梅毒等感染、脑肿瘤、硬膜下血肿、反复脑外伤、维生素缺乏症（尤其是缺乏维生素 B12）、甲状腺疾病和其他代谢紊乱。反复的脑外伤会导致所谓的慢性创伤性脑病。最近报道了许多美国职业运动员的慢性创伤性脑病病例。在一些患者中，精神分裂症或抑郁症可能类似于痴呆症。埃米尔·克雷佩林选择术语“早发性痴呆”来描述我们现在称为精神分裂症的认知疾病）。因为一些痴呆症是可以治疗的，所以医生根据临床病史、体检和实验室研究来探索痴呆症的鉴别诊断是很重要的。

## 64.3 阿尔茨海默病是痴呆症最常见的原因

1901 年，阿尔茨海默检查了一名中年妇女，她出现了认知能力逐渐丧失的情况。她的记忆力越来越差。她甚至在自己的家中也无法辨别方向，她也把东西藏在了自己的公寓里。有时，她认为人们打算谋杀她。

她被送进了一家精神病院，并在阿尔茨海默博士第一次见到她大约 5 年后去世。死后，阿尔茨海默进行了

尸检，发现了大脑皮层的特定改变，如下所述。一系列行为症状和身体改变随后被命名为阿尔茨海默病。

这个病例引起了阿尔茨海默的注意，因为它发生在中年；阿尔茨海默病的最初临床表现（通常是记忆力减退和执行功能下降）最常出现在 65 岁以后。70 岁时阿尔茨海默病的患病率约为 2%，而 80 岁后则超过 20%。65 岁之前的早发病例通常是家族性的（常染色体显性遗传性阿尔茨海默病），并且已经在其中许多患者中发现了基因突变，我们将在下面讨论。事实上，最近对第一例阿尔茨海默病患者保存的大脑样本进行的新基因测试表明，她的疾病是由一种叫做早老素-1 的基因突变引起的，这是家族性或显性遗传性阿尔茨海默病的最常见原因。迟发性阿尔茨海默病（65 岁或以上发病）通常是散发性的，这意味着不存在显性遗传性阿尔茨海默病中出现的单一致病基因。尽管如此，很明显，遗传学甚至更可能通过影响易感性的变异，以及刚刚被发现的环境和其他促成因素，对晚发性阿尔茨海默病的风险做出巨大贡献。

阿尔茨海默病的早发型和晚发型类型通常都表现出情景记忆和执行功能的选择性缺陷。起初，语言、力量、响应、感觉能力和运动技能几乎正常。然而，记忆和注意力会逐渐丧失，连同解决问题、语言、计算和视觉空间感知等认知能力也会丧失。不出所料，这些认知丧失会导致行为改变，一些患者会出现幻觉和妄想等精神病症状。所有患者均出现精神功能和日常生活活动进行性损害；在晚期阶段，他们变得哑巴、大小便失禁和卧床不起。

阿尔茨海默病影响大约 1/8 的 65 岁以上老年人。现在美国有超过 500 万人因阿尔茨海默病而患上痴呆症。由于老年人口快速增加，阿尔茨海默病风险人群也在快速增长。在接下来的 25 年里，美国患有阿尔茨海默病的人数预计将增加 2 倍，照顾无法自理的患者的费用也将增加 3 倍。因此，阿尔茨海默病是社会的一个主要公共健康问题。

## 64.4 阿尔茨海默病患者的大脑因萎缩、淀粉样斑块和神经原纤维缠结而改变

在阿尔茨海默病中发现了 3 类大脑异常。首先，如图 64.4.1 所示，由于神经元和突触丢失，大脑萎缩，脑回变窄，脑沟变宽，脑重量减轻，脑室扩大。这些变化也以较轻微的形式出现在因其他原因死亡的认知完好老年人身上。因此，阿尔茨海默病是一种神经退行性疾病。

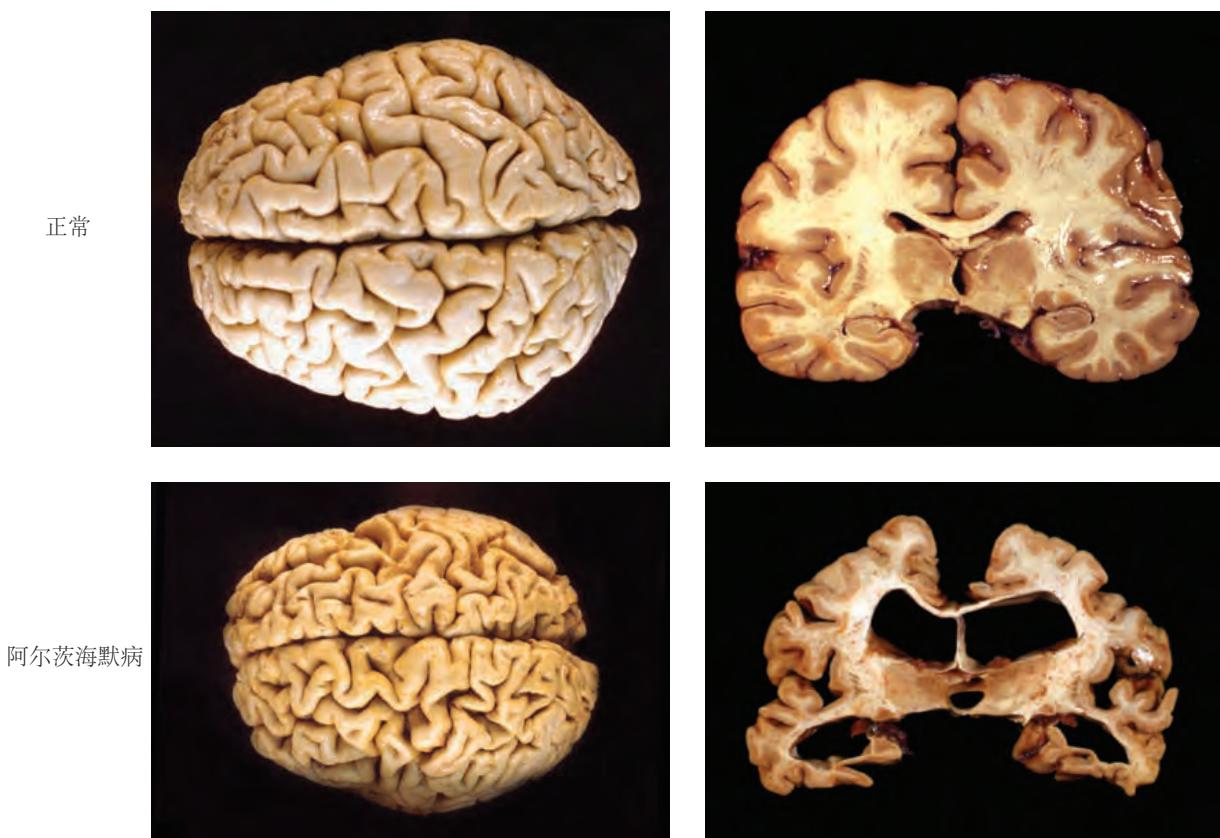
其次，阿尔茨海默病患者的大脑含有主要由聚集形式的称为淀粉样蛋白- $\beta$  或 A $\beta$  的肽组成的细胞外斑块，它是从正常产生的蛋白质中切割下来的。如图 64.4.2 所示，A $\beta$  的聚集体称为淀粉样斑块。斑块中的大部分 A $\beta$  是纤维状的；A $\beta$  的聚集体与其他与 A $\beta$  共聚集的蛋白质一起出现在  $\beta$  折叠片构象中。当用刚果红等染料染色时，淀粉样蛋白可以被检测到，当在偏振光下观察时，或者当用硫黄素 S 染色并用荧光光学器件观察时，淀粉样蛋白是折射的。淀粉样蛋白的细胞外沉积物被肿胀的轴突和树突包围（神经炎性营养不良）。这些神经元过程又被激活的星形胶质细胞和小胶质细胞（炎症细胞）的细胞过程所包围。A $\beta$  还可以在大脑小动脉壁形成淀粉样沉积物，产生所谓的脑淀粉样血管病。这在高达 90% 的阿尔茨海默病患者中不同程度地发生，但它也可以独立于阿尔茨海默病发生。脑淀粉样血管病可导致缺血性中风，是老年人出血性中风的常见原因。

第三，如图 64.4.2 所示，许多受到阿尔茨海默病病理学影响但仍然存活的神经元具有细胞骨架异常，其中最显著的是神经原纤维缠结和神经纤维丝的积累。缠结是细胞体和树突中的丝状内含物，包含成对的螺旋丝和 15 纳米直丝。这些细丝由正常微管相关蛋白 tau 的聚集形式组成。

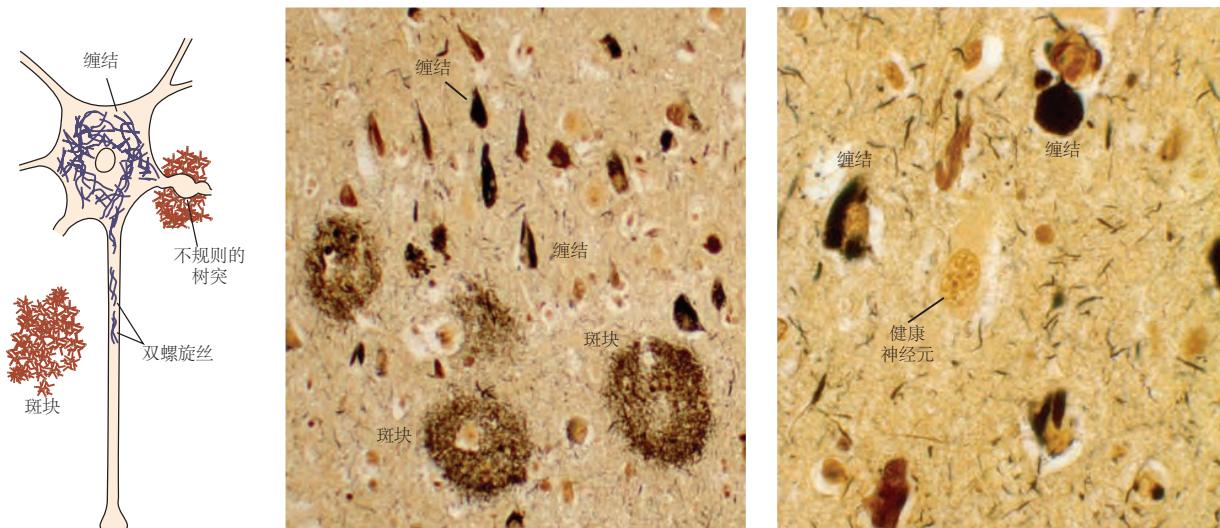
在阿尔茨海默病中，缠结不是均匀分布于整个大脑，而是会影响特定区域。如图 64.4.3 所示，内嗅皮层、海马体、部分新皮层和基底核特别脆弱。内嗅皮层和海马体的改变可能是情景记忆问题的基础，而情景记忆是阿尔茨海默病的首发症状之一。基底前脑胆碱能系统的异常可能导致认知困难和注意力缺陷。这些胆碱能异常与额纹状体回路中的异常形成对比，后者与正常受试者的年龄相关认知能力下降相关。解剖差异、病理变化、广泛的神经元死亡和基因突变（见下文）的结合反对曾经流行的观点，即阿尔茨海默病是正常衰老过程的异常形式。

### 64.4.1 淀粉样斑块含有有助于阿尔茨海默病病理学的有毒肽

淀粉样斑块的主要成分，即 A $\beta$  肽的聚集体，基于其低溶解度，于 1980 年代初首次通过离心分离。主要肽的长度为 40 和 42 个氨基酸（40 个残基加上羧基末端的 2 个额外氨基酸）。生化研究表明，A $\beta$ 42 肽比 A $\beta$ 40 更



**图 64.4.1:** 阿尔茨海默病患者大脑的明显病理变化。与年龄匹配的正常大脑相比，阿尔茨海默病患者的大脑显示出明显的萎缩和脑室扩大（另请参见图 64.1.2）。



**图 64.4.2:** 阿尔茨海默病大脑中的斑块和缠结。患有严重阿尔茨海默病的人的大脑皮层部分显示出特征性斑块和神经原纤维缠结。左图：该图显示了 1 个神经元，其细胞体和轴突中含有神经原纤维缠结。淀粉样斑块显示在神经细胞中；其中一个围绕着一个树突，树突显示出一种改变的、肿胀的形状。缠结由成对的螺旋丝束组成，由过度磷酸化的 tau 蛋白的异常聚合物组成，而淀粉样斑块是淀粉样蛋白- $\beta$  (A4) 肽聚合物的细胞外沉积物。中图：阿尔茨海默病患者的新皮层部分经银染处理后显示含有神经原纤维缠结的神经元细胞体和含有淀粉样蛋白斑块的神经细胞。右：皮层的更高放大倍数显示神经元细胞体中的神经原纤维缠结和没有缠结的健康神经元。在神经胶质细胞中可以看到许多薄的银阳性细胞突起。



图 64.4.3: 神经原纤维缠结和老年斑集中在阿尔茨海默病大脑的不同区域<sup>[588]</sup>。

快地成核成淀粉样原纤维。

相当多的实验证据表明,  $\text{A}\beta_{42}$  驱动初始聚集, 尽管  $\text{A}\beta_{40}$  也在显著程度上积累, 尤其是在脑淀粉样血管病中。对于培养的神经元, 比单体大的  $\text{A}\beta_{42}$  肽形式通常比  $\text{A}\beta_{40}$  的聚集形式毒性更大。这些结果暗示  $\text{A}\beta_{42}$  是淀粉样蛋白形成和  $\text{A}\beta$  毒性的关键驱动因素。

一旦发现长度为 38 至 43 个氨基酸的  $\text{A}\beta$  肽是由前体蛋白的裂解形成的, 研究人员便着手分离前体。该前体于 20 世纪 80 年代中期被发现, 经过分子克隆, 并命名为淀粉样前体蛋白。它是一种大型跨膜糖蛋白, 存在于所有类型的细胞中, 但在神经元中表达水平最高。淀粉样前体蛋白在大脑中的正常功能尚不清楚。

淀粉样前体蛋白是如何加工形成  $\text{A}\beta$  肽的? 结果证明答案很复杂。 $\alpha$ -、 $\beta$ -和  $\gamma$ -分泌酶这 3 种酶将淀粉样前体蛋白切成碎片。 $\beta$ - 和  $\gamma$ - 分泌酶裂解淀粉样前体蛋白产生可溶性细胞外片段, 释放到间质液中。如图 64.4.4 所示, 这些是  $\text{A}\beta$  肽, 包括淀粉样前体蛋白的跨膜部分。 $\gamma$ -分泌酶的切割是不寻常的, 因为它发生在淀粉样前体蛋白的跨膜部分, 该区域长期以来被认为不受水解影响, 因为它被脂质而不是水包围。在  $\text{A}\beta$  序列中间被  $\alpha$ -分泌酶切割可防止  $\text{A}\beta$  肽的形式。

已经分离和表征了负责  $\alpha$ -、 $\beta$ - 和  $\gamma$ - 分泌酶的酶。 $\alpha$ -分泌酶是称为一种去整合蛋白和金属蛋白酶的细胞外蛋白酶大家族的成员, 负责降解细胞外基质的许多成分。 $\beta$ -分泌酶, 称为 BACE1 ( $\beta$ -位点淀粉样前体蛋白裂解酶 1), 是中枢神经元中的一种跨膜蛋白, 集中在突触中。来自缺乏 BACE1 的突变小鼠的脑细胞不产生  $\text{A}\beta$  肽, 证明 BACE1 确实是神经元  $\beta$ -分泌酶。 $\gamma$ -分泌酶是三者中最复杂的, 实际上是一种多蛋白复合物, 可以切割几种不同的跨膜蛋白。正如预期的那样, 鉴于其在膜内发挥作用的特殊能力,  $\gamma$ -分泌酶本身包括几种跨膜蛋白。其中 2 个称为早老素 1 和早老素 2, 反映了它们与 阿尔茨海默病的关联。该复合物的其他成分包括跨膜蛋白 nicastrin、Aph-1 和 Pen-2。

尽管  $\text{A}\beta$  和淀粉样前体蛋白的生化特性很有趣, 但关键问题是它们是否参与了阿尔茨海默病的衰弱症状。该疾病可能是由  $\text{A}\beta$  积累引起的, 但  $\text{A}\beta$  本身可能是另一种病理过程的结果, 甚至是无害的相关因素。人类和实验动物的遗传证据对于证明淀粉样前体蛋白, 特别是  $\text{A}\beta$  在阿尔茨海默病中发挥核心作用至关重要。

第一条线索来自对淀粉样前体蛋白基因位于 21 号染色体上的观察, 唐氏综合症患者 (也称为 21 三体综合症) 中存在 3 个拷贝, 而不是正常的 2 个拷贝。所有活到中年的唐氏综合症患者都会在 50 岁左右出现阿尔茨海默病病理和痴呆症。这种关联与淀粉样前体蛋白通过在整个生命过程中过量产生淀粉样前体蛋白和  $\text{A}\beta$  50% 来诱发阿尔茨海默病的观点是一致的。然而, 许多基因的拷贝在 21 三体个体中以 3 个拷贝存在, 最初, 尚不清楚唐氏综合症中淀粉样前体蛋白的 3 倍体是导致该人群阿尔茨海默病的原因。随后, 由于人类 21 号染色体上淀粉样前体蛋白基因座的重复, 发现了在没有唐氏综合症的情况下同时发生阿尔茨海默病和脑淀粉样血管病的罕见家族。这是强有力的数据表明, 仅淀粉样前体蛋白的过度表达就足以导致阿尔茨海默病和脑淀粉样血管病。

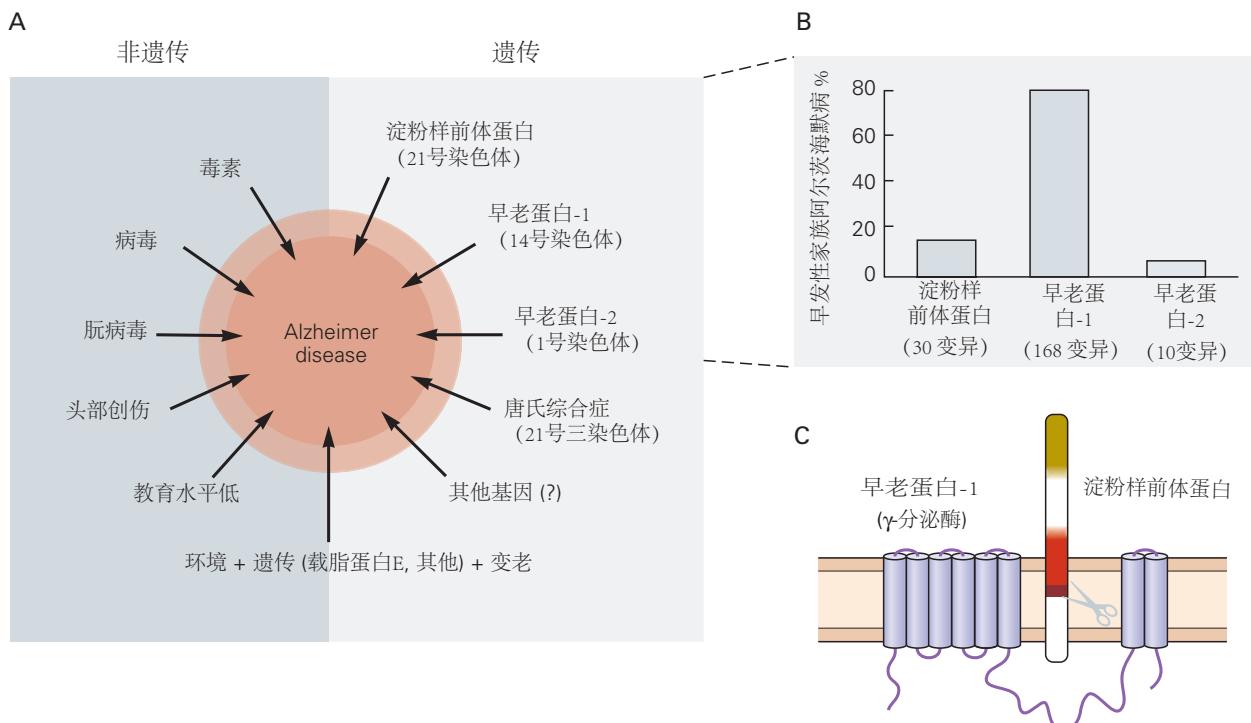
更直接的遗传证据来自对罕见的显性遗传性阿尔茨海默病患者的分析, 这些患者的症状发作通常在 30 至 50 岁之间。在 20 世纪 80 年代后期, 几个研究小组开始使用分子克隆方法来鉴定在显性遗传阿尔茨海默病中发生突变的基因。值得注意的是, 如图 64.4.5 所示, 识别出的前 3 个基因是编码蛋白质淀粉样前体蛋白、presenilin-1 和 presenilin-2 的基因。在这 3 个基因中发现了许多不同的突变, 大多数影响淀粉样前体蛋白的切割, 增加  $\text{A}\beta$  肽的产生, 或者特别是更容易聚集的  $\text{A}\beta_{42}$  物种的比例。有趣的是, 一些淀粉样前体蛋白突变发生在  $\text{A}\beta$  序列本身内, 不会影响  $\text{A}\beta$  的产生, 但会影响  $\text{A}\beta$  的聚集和从大脑中清除。

一些淀粉样前体蛋白突变是  $\text{A}\beta$  区域两侧的氨基酸置换。在  $\beta$ -分泌酶切割位点表达双重突变的细胞 (所谓的瑞典突变) 是  $\text{A}\beta$  形成所必需的, 其分泌的  $\text{A}\beta$  肽比表达野生型淀粉样前体蛋白的细胞多几倍。有趣的是, 最近发现了与  $\beta$ -分泌酶位点相邻的淀粉样前体蛋白中的另一个突变。这种突变似乎通过减少  $\text{A}\beta$  的产生来预防阿尔茨海默病。另一个淀粉样前体蛋白突变导致  $\gamma$ -分泌酶产生更大比例的较长  $\text{A}\beta$  种类 (例如  $\text{A}\beta_{42}$ ) 相对于较短的种类 (例如  $\text{A}\beta_{40}$ )。同样, 在大多数早老素突变体中, 突变体  $\gamma$ -分泌酶的活性高于正常水平或产生  $\text{A}\beta_{42}$  与  $\text{A}\beta_{40}$  比例增加的肽。

这些人类遗传学研究提供了令人信服的证据, 证明 (1) 淀粉样前体蛋白裂解产生  $\text{A}\beta$  和  $\text{A}\beta$  聚集的倾向在某些显性遗传的早发性阿尔茨海默病病例中起着关键的促进作用, 以及 (2) 较少的  $\text{A}\beta$  产生降低了晚发的风险。小鼠遗传学研究也加强了淀粉样前体蛋白切割, 特别是  $\text{A}\beta$  聚集导致阿尔茨海默病的情况。转基因表达或敲入与常染色体显性遗传阿尔茨海默病中发现的相同的突变淀粉样前体蛋白形式导致海马和皮层中出现淀粉样蛋白斑



**图 64.4.4:** 淀粉样蛋白前体蛋白的加工、 $\text{A}\beta$  肽的产生以及对 tau 聚集的下游影响。 $\text{A}\beta$  肽是由淀粉样蛋白前体蛋白（一种跨膜蛋白）通过 2 种酶 ( $\beta$ -分泌酶和  $\gamma$ -分泌酶) 裂解产生的 ( $\alpha$ -分泌酶的切割可防止  $\text{A}\beta$  的产生)。早老素是  $\gamma$ -分泌酶复合物的活性酶促成分，可在膜内的多个位点切割淀粉样蛋白以产生不同长度的  $\text{A}\beta$  肽，例如  $\text{A}\beta_{38}$ 、 $\text{A}\beta_{40}$  和  $\text{A}\beta_{42}$ 。淀粉样蛋白前体蛋白中位于  $\text{A}\beta$  区域之外或  $\text{A}\beta$  编码序列内的几种突变会导致常染色体显性阿尔茨海默病的形式。淀粉样蛋白前体蛋白/ $\text{A}\beta$  氨基酸序列中的氨基酸（蓝色）代表淀粉样蛋白前体蛋白中的正常氨基酸；绿色氨基酸（低于正常序列）是导致家族性阿尔茨海默病或脑淀粉样血管病变的氨基酸。 $\text{A}\beta$  主要由核内体内的淀粉样蛋白前体蛋白产生。多种分子和突触活动调节  $\text{A}\beta$  水平。有证据表明  $\text{A}\beta$  聚集受  $\text{A}\beta$  结合分子 ApoE 和凝聚素的影响，它们可能在大脑的细胞外空间相互作用。多种分子和过程影响  $\text{A}\beta$  从存在于大脑细胞外空间的间质液中清除，包括脑啡肽酶和胰岛素降解酶，以及脑脊髓液和间质液体积流量。LRP1 和晚期糖基化终产物受体似乎影响  $\text{A}\beta$  穿过血脑屏障的转运。 $\text{A}\beta$  的浓度和类型会影响聚集 ( $\text{A}\beta_{42}$  更易形成纤维)。一旦它聚集成低聚物和原纤维，它就会对细胞产生直接毒性，诱发炎症，并通过尚不清楚的机制加剧可溶性 tau 向聚集 tau 的转化。除  $\text{A}\beta$  外，还有多种因素影响 tau 聚集和毒性，包括 tau 水平、序列和磷酸化状态。



**图 64.4.5:** 环境和遗传因素在阿尔茨海默病中发挥作用。A. 环境因素和遗传因素。B. 早发性阿尔茨海默病中涉及的特定基因。C. 早老蛋白-1 ( $\gamma$  分泌酶复合物的一种成分) 与质膜内的淀粉样前体蛋白相关。

块、 $\text{A}\beta$  沉积物附近的营养不良神经突、淀粉样蛋白斑块周围突触末梢密度降低和损伤，以及突触传递受损。一些小鼠模型出现比如空间记忆和情景记忆缺陷的功能异常。在表达改变形式的淀粉样前体蛋白和早老蛋白-1 的转基因小鼠中，改变更为严重。重要的是要注意，尽管这些小鼠不会出现 tau 聚集或神经原纤维缠结，这些病变被认为在阿尔茨海默病中的认知能力下降中很重要，但它们仍然是解决  $\text{A}\beta$  的机制作用和阿尔茨海默病发病机制中相关病理学的宝贵模型，尤其是  $\text{A}\beta$  的作用，以及用于测试潜在疗法。

鉴于淀粉样前体蛋白裂解参与阿尔茨海默病发病机制的有力证据，下一个问题是：裂解产物的积累如何导致症状并最终导致痴呆？存在 3 组切割产物：分泌的细胞外区域（胞外域）、 $\text{A}\beta$  肽和细胞质片段。尽管所有这 3 个片段都可能对实验动物的神经元产生有害影响，但  $\text{A}\beta$  肽受到的关注最多，而且其参与的证据也是最有力的。有证据表明， $\text{A}\beta$  的不同聚集形式（例如低聚物、原纤维和纤维丝）可导致突触和神经元损伤，从而可能导致阿尔茨海默病。

## 64.4.2 神经原纤维缠结含有微管相关蛋白

如图 64.4.2 所示，直到 2005 年左右，大多数关于阿尔茨海默病分子和细胞基础的研究都集中在  $\text{A}\beta$  肽和淀粉样斑块上，但神经原纤维缠结中的 tau 聚集似乎在阿尔茨海默病的进展中起着关键作用。如图 64.4.6 所示，分子分析表明，细胞体和近端树突中的这些异常内含物含有过度磷酸化的 tau 异构体的聚集体，tau 是一种通常可溶的微管结合蛋白。tau 蛋白通过结合并稳定微管，在细胞内运输中发挥关键作用，尤其是在轴突中。轴突运输受损会损害突触稳定性和营养支持。虽然 tau 蛋白的聚集和过度磷酸化导致毒性的机制尚不清楚，但 tau 蛋白的积累显然与神经元变性有关。

尽管缠结是阿尔茨海默病的一个决定性特征，但最初并不清楚缠结和过度磷酸化形式的 tau 在疾病的发病机制中扮演什么角色。虽然淀粉样前体蛋白和早老素基因的突变可导致阿尔茨海默病，但在家族性阿尔茨海默病中未发现 tau 基因的突变。然而，现在有大量证据表明 tau 聚集是阿尔茨海默病中发生的神经变性的关键因素。

首先，在多种神经退行性疾病中都可以看到过度磷酸化 tau 的丝状沉积物，包括阿尔茨海默病、各种形式的额颞痴呆、进行性核上性麻痹、皮层基底节变性和慢性创伤性脑病。其次，已发现 tau 基因突变是另一种常染色

**A 健康神经元****B 阿尔茨海默病神经元**

**图 64.4.6:** 神经原纤维缠结的形成。A. 在健康的神经元中，tau 蛋白与正常的微管结合但不是成对的螺旋丝，并有助于神经元的结构完整性。B. 在患病的神经元中，tau 蛋白变得过度磷酸化并失去与开始分解的正常微管的联系。然后它形成成对的螺旋丝，被隔离在神经原纤维缠结中。

体显性神经退行性疾病形式的基础：额颞叶痴呆伴帕金森病 17 型。在没有 A<sub>β</sub> 沉积的情况下，这些患者在特定脑区发生 tau 聚集和脑萎缩。第三，阿尔茨海默病的进行性症状与缠结的数量和分布的相关性要好于与尸检中观察到的淀粉样蛋白斑块的相关性。例如，如图 64.4.7 所示，在该区域出现斑块之前，缠结通常首先在内嗅皮层和海马体（早期记忆障碍的可能部位）的神经元中出现。



**图 64.4.7：**生物标志物变化与阿尔茨海默病认知和临床变化的关系。在将要发展为阿尔茨海默病痴呆症的认知正常人群中，最初的体征之一是 A<sub>β</sub> 以淀粉样蛋白斑块的形式在大脑中开始聚集。虽然人们的认知能力仍然正常，但淀粉样斑块会继续积累。在某个时候，大约在任何明显的认知衰退发生前 5 年，tau 蛋白在新皮层中的积累开始增加，炎症和氧化应激增加，大脑网络连接和新陈代谢开始下降。神经元和突触丢失以及脑萎缩也开始了。这个时期（当患者保持认知正常但阿尔茨海默病型病理正在形成时）被称为临床前阿尔茨海默病。一旦有足够的神经元和突触功能障碍以及细胞丢失，就会出现非常轻度的痴呆和轻度认知障碍。那时，淀粉样蛋白沉积几乎达到顶峰。随着痴呆症恶化到轻度、中度和重度阶段，神经原纤维缠结形成，神经元和突触功能障碍、炎症、细胞死亡和脑萎缩恶化<sup>[589]</sup>。

多年来，那些认为 A<sub>β</sub> 是阿尔茨海默病的主要致病因子的人和那些认为富含 tau 蛋白的缠结起主要作用的人之间一直存在争议。这些坚定的支持者分别被称为浸礼宗和 Tau 信徒。浸礼宗指出，在症状出现前约 15 年开始的阿尔茨海默病病理学发展过程中，新皮层 A<sub>β</sub> 的积累先于新皮层 tau 病理学的发展。然而，最近的证据表明，A<sub>β</sub> 的积累似乎以某种方式驱动 tau 蛋白在大脑中聚集和扩散。因此，A<sub>β</sub> 聚集可能会引发疾病，而 tau 聚集和扩散可能是导致神经变性的主要方式。例如，同时表达突变淀粉样前体蛋白和突变 tau 的转基因小鼠会出现更严重的 tau 病理学。

斑块和缠结之间似乎存在相互作用。将 A<sub>β</sub>42 注射到表达突变 tau 蛋白的转基因小鼠的特定脑区会增加附近神经元的缠结数量。此外，减少斑块数量和大小的操作会导致过度磷酸化 tau 水平降低。重要的是，最近的实验表明，A<sub>β</sub> 沉积以某种方式促进 tau 聚集体从一个大脑区域扩散到另一个大脑区域，可能以类似朊病毒的方式跨突触扩散。这一过程的细节仍有待制定，并且可能极其重要。

现在有大量来自细胞培养和动物模型研究的证据表明，在神经退行性疾病中聚集的几种蛋白质，包括 tau 和突触核蛋白，可以以类似朊病毒的方式在细胞之间传播。这作为一种潜在的疾病机制尤为重要。例如，如果错误折叠蛋白质的细胞间传播发生在细胞外空间，则该过程可能会被针对适当的疾病相关蛋白质的抗体打断。事实上，这现在已成为多项针对 tau 和突触核蛋白的人体临床试验的基础。

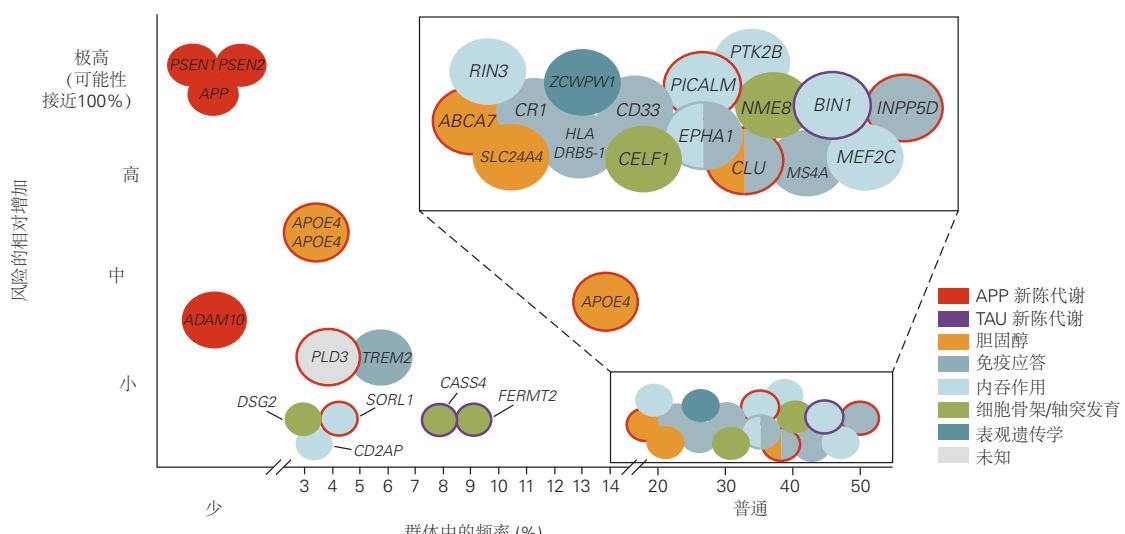
### 64.4.3 已经确定了阿尔茨海默病的危险因素

极少数个体因携带淀粉样前体蛋白或早老素基因的常染色体显性突变等位基因而患上阿尔茨海默病，并且这些通常属于早发型。几乎所有迟发性阿尔茨海默病病例都是由淀粉样前体蛋白或早老素基因突变引起的。那

么，我们可以预测这些人的阿尔茨海默病吗？

主要的风险因素是年龄。这种疾病存在于 60 岁以下的极少数人群中（其中许多是常染色体显性遗传病例），60 至 70 岁人群中的 1% 至 3%，70 至 80 岁人群中的 3% 至 12%，以及 25% 到 40% 的 85 岁以上的老年人。然而，知道老年人是阿尔茨海默病的主要候选人几乎没有治疗作用，因为现代医学无法减缓时间的流逝。因此，人们对影响阿尔茨海默病发病率的其他因素产生了浓厚的兴趣。

迄今为止，发现的迟发性阿尔茨海默病最重要的遗传风险因素是载脂蛋白 E 基因的等位基因。ApoE 蛋白是一种载脂蛋白。在血液中，它在血浆胆固醇代谢中起重要作用。它也在大脑中以高水平表达，最突出的是星形胶质细胞，在一定程度上是小胶质细胞。在大脑中，其正常功能尚未阐明，它被分泌为高密度样脂蛋白的成分。在人类中，载脂蛋白 E 基因有 3 个等位基因，载脂蛋白 E2、载脂蛋白 E3 和载脂蛋白 E4，它们之间至多相差 2 个氨基酸。携带载脂蛋白 E4 等位基因的人有患阿尔茨海默病的风险，而携带载脂蛋白 E2 等位基因的人相对于具有最常见载脂蛋白 E3/载脂蛋白 E3 基因型的人而言可免受阿尔茨海默病的侵害。载脂蛋白 E4 等位基因存在于大约 25% 的普通人群中，但存在于多达 60% 的阿尔茨海默病患者中。如图 64.4.8 所示，相对于载脂蛋白 E3/E3 的人，一个载脂蛋白 E4 等位基因拷贝增加阿尔茨海默病风险约 3.7 倍，2 个拷贝增加约 12 倍。相对于 APOE3/APOE3，一个载脂蛋白 E2 等位基因拷贝可将阿尔茨海默病风险降低约 40%。



**图 64.4.8：**罕见和常见的基因变异导致阿尔茨海默病的风险。数据来自全基因组关联研究。导致早发性家族性阿尔茨海默病 (PSEN1、PSEN2 和淀粉样前体蛋白) 的 3 个基因突变很少见，但如果他们活到中年，几乎 100% 的携带这些突变的人都会患上阿尔茨海默病。在人群中相对频繁出现的基因（例如 ABCA7、CLU、BIN1）周围区域或基因中发现了许多常见的遗传变化，这些变化影响阿尔茨海默病的风险，但影响程度非常小。载脂蛋白 E4 是阿尔茨海默病的一种常见且强烈的遗传风险因素，存在于大约 20% 至 25% 的人口中（等位基因频率约为 15%）。相对于载脂蛋白 E3 纯合子，一个载脂蛋白 E4 拷贝将风险增加约 3.7 倍，2 个拷贝将风险增加约 12 倍<sup>[590]</sup>。

载脂蛋白 E4 易患阿尔茨海默病而载脂蛋白 E2 预防阿尔茨海默病的机制尚不确定，但载脂蛋白 E4 通过减少 A $\beta$  清除和促进原纤维化（载脂蛋白 E4 > 载脂蛋白 E3 > 载脂蛋白 E2）明显促进 A $\beta$  聚集。它还可能通过其他机制发挥作用，例如影响 tau、先天免疫系统、胆固醇代谢或突触可塑性，尽管这些通路仍有待研究。

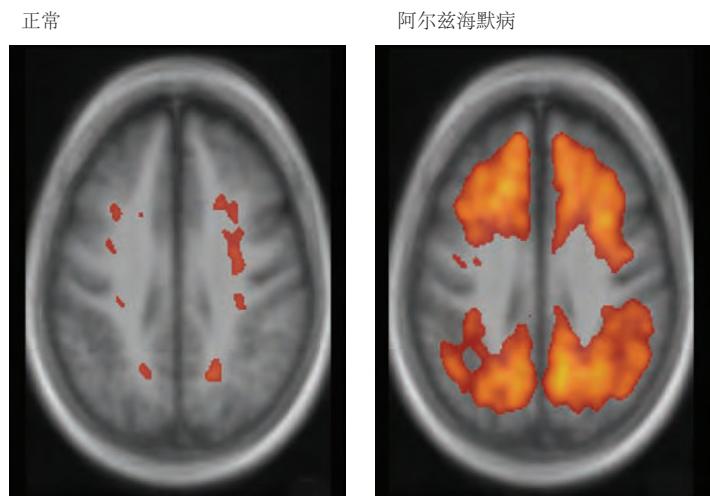
许多其他基因和基因位点影响迟发性阿尔茨海默病的风险。如图 64.4.8 所示，有些是仅轻微改变风险的常见变体，而其他较罕见的变体会更大程度地增加风险。例如，TREM2 基因中相对罕见的突变使阿尔茨海默病的风险增加 1 倍或 3 倍，类似于具有一个载脂蛋白 E4 等位基因拷贝。这很有趣，因为 TREM2 以及另一个与阿尔茨海默病风险相关的基因 CD33 仅在小胶质细胞中表达。与其他新出现的细胞和动物模型数据一起，这一发现表明先天免疫系统参与了阿尔茨海默病发病机制。正在研究其他一些在不同程度上增加风险的罕见变异。这些发展似乎最终会导致更加个性化的临床方法来确定阿尔茨海默病的风险，特别是随着疾病治疗的出现。

## 64.5 现在可以很好地诊断阿尔茨海默病，但可用的治疗方法并不令人满意

在缺乏生物标志物的情况下早期诊断阿尔茨海默病可能具有挑战性，因为它的初始症状可能与正常的年龄相关认知衰退或其他相关疾病的症状相似。然而，阿尔茨海默病引起的轻度至中度痴呆的诊断通常相当准确。事实上，在过去的几十年里，准确诊断疾病的能力有所提高，主要是因为3个因素。

首先，身体、神经和神经心理检查的规程变得更加复杂和标准化。其次，增加对核磁共振成像揭示的结构变化的了解有助于早期诊断阿尔茨海默病。例如，现在可以根据核磁共振成像可见的皮层变薄和心室扩大来预测哪些轻度认知损伤患者会发展为阿尔茨海默病，准确率约为80%。这些成像和诊断方法还有助于区分痴呆综合症，并将结构缺陷与功能缺陷联系起来。例如，患有被称为额颞痴呆行为变异的疾病的患者会在早期经历人格改变，并且该阶段的核磁共振成像显示额叶和/或颞叶萎缩。同样，阿尔茨海默病最初的困难通常集中在记忆力和注意力上，而核磁共振成像揭示了内侧颞叶皮层和海马体的初始改变。

第三，也许是最有前途的，淀粉样斑块和神经原纤维缠结可以通过正电子发射断层成像使用强烈结合纤维状A $\beta$ 或聚集形式的tau的化合物进行可视化。如图64.5.1所示，其中第一个，匹兹堡化合物B，以高亲和力结合纤维状A $\beta$ ；它的放射性形式，用短寿命的碳或氟同位素标记，很容易被正电子发射断层成像检测到。美国食品和药物管理局已批准3种淀粉样蛋白显像剂：洛贝平（Amyvid）、富特米他（Vizamyly）和氟比他班（Neuraceq）。



**图 64.5.1：**正电子发射断层扫描可以显示活体大脑中的淀粉样斑块。A $\beta$ 斑块的密度由这些图像中的红色区域表示，这些图像是在施用匹兹堡化合物B后制作的，这是一种硫黄素T的荧光类似物。

阿尔茨海默病安全分子标记的可用性允许在出现临床症状之前识别疾病的早期阶段。同样重要的是，它可以改进临床试验患者的选择，以及更敏锐地选择受试者以进行正常衰老的详细分析。重要的是要注意，这些变化也可以在脑脊液中检测到，当存在淀粉样蛋白沉积时，A $\beta$ 42的水平会下降，总tau和磷酸化形式的tau会随着神经变性和tau聚集而增加。

当然，如果有可以在早期阶段阻止或减缓其进展的可用治疗方法，改进阿尔茨海默病的诊断将是最有价值的。虽然我们仍然没有延迟阿尔茨海默病发作或减缓阿尔茨海默病进展的治疗方法，但希望我们离能够减轻症状不会太远。虽然没有明确的证据，但有充分的证据表明各种生活方式因素可以降低患阿尔茨海默病的风险。这些包括高水平的教育、认知刺激、保持社交参与、定期锻炼、不超重以及获得适量的睡眠。目前的疗法侧重于治疗相关症状，例如抑郁、情绪激动、睡眠障碍、幻觉和妄想。

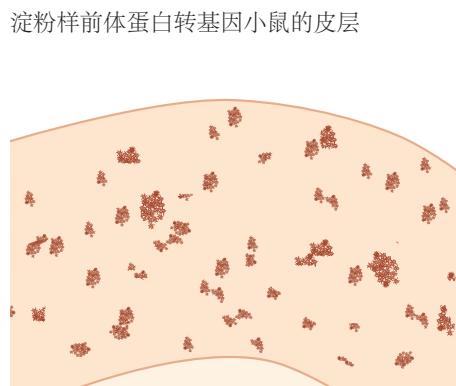
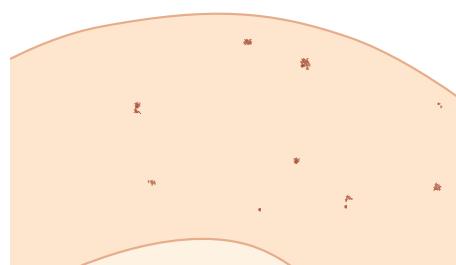
迄今为止，治疗的一个主要目标是针对基底前脑中的胆碱能系统，这是一个在阿尔茨海默病中受损并有助于注意力的大脑区域。乙酰胆碱酯酶抑制剂通过抑制乙酰胆碱的分解来提高乙酰胆碱的水平，是美国食品和药物管理局批准用于治疗阿尔茨海默病的少数几种药物之一。另一种药物N-甲基-D-天冬氨酸受体拮抗剂美金刚也可改善因阿尔茨海默病导致的轻度至中度痴呆患者的症状。美金刚被认为能够调节谷氨酸介导的神经传递。然而，这些药物对改善认知功能和日常生活活动的影响并不大。

我们对阿尔茨海默病细胞生物学基础理解的最新进展产生了几个有希望的新治疗靶点，所有这些靶点都在深入探索中。一种方法是开发降低或调节  $\beta$ - 和  $\gamma$ - 分泌酶活性的药物，这些酶切割淀粉样前体蛋白以产生 A $\beta$  肽和相关的可溶性细胞外片段和细胞内片段。事实上，降低过表达突变淀粉样前体蛋白的转基因小鼠中的  $\beta$ - 或  $\gamma$ - 分泌酶水平会减少 A $\beta$  沉积，并且在某些情况下会减少功能异常。

因此，制药公司开发了降低或调节人体  $\beta$ - 和  $\gamma$ - 分泌酶水平的药物。这种方法的一个障碍是分泌酶还作用于淀粉样前体蛋白以外的底物，因此降低它们的水平可能会产生有害的副作用。对于  $\gamma$ - 分泌酶尤其如此，其抑制作用已导致阿尔茨海默病人体试验中的毒性。如图 64.4.7 所示，现在有几种  $\beta$ - 分泌酶抑制剂在阿尔茨海默病的临床试验中，这些药物很可能也会进入所谓的临床前阿尔茨海默病试验，此时阿尔茨海默病病理正在积累但还没有认知衰退的迹象。这种疗法的目标是延缓或预防认知能力下降和痴呆症的发生。

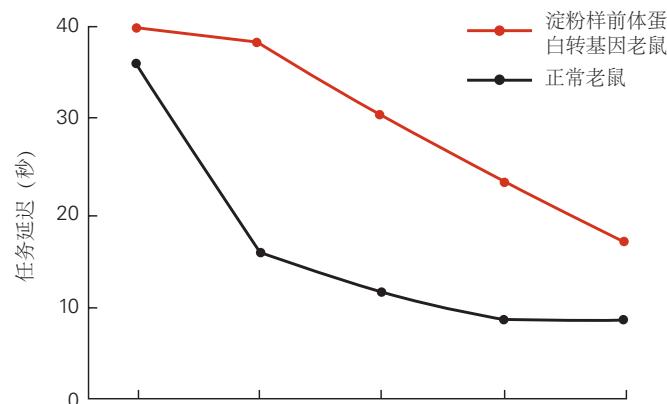
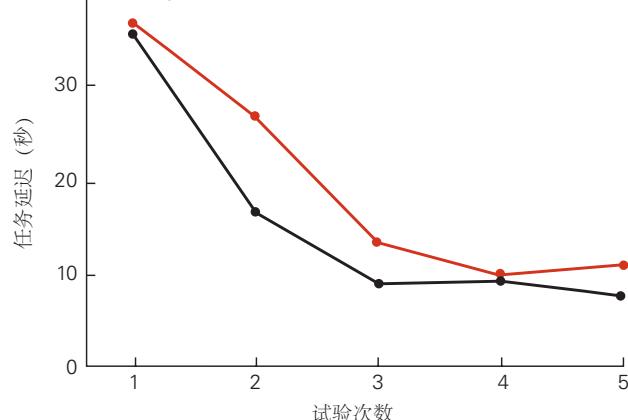
另一种方法是通过免疫学手段降低 A $\beta$  水平。导致产生 A $\beta$  抗体的 A $\beta$  免疫和 A $\beta$  抗体的被动转移都已在阿尔茨海默病的转基因小鼠模型中进行了测试。如图 64.5.2 所示，2 种治疗均已显示可降低 A $\beta$  水平、A $\beta$  毒性和斑块。增强 A $\beta$  清除的机制尚不清楚。血清抗体可能起到“接收器”的作用，导致低分子量的 A $\beta$  肽从大脑中更广泛地清除到循环中，从而改变不同隔室中 A $\beta$  的平衡并促进 A $\beta$  从大脑中去除。

A 淀粉样斑块沉积

突变淀粉样前体蛋白  
转基因小鼠 A $\beta$  1-42 免疫后的皮层

B 记忆任务

用无关蛋白免疫小鼠

用 A $\beta$  1-42 免疫的小鼠

**图 64.5.2:** 用 A $\beta$  肽抗体进行免疫可清除淀粉样斑块并保持表达该肽的小鼠认知能力。用 A $\beta$  肽免疫以淀粉样斑块形式形成 A $\beta$  沉积的小鼠。这导致了针对 A $\beta$  的抗体的产生。A. 过表达突变淀粉样前体蛋白转基因小鼠的大脑皮层淀粉样斑块沉积的比较，该小鼠会形成淀粉样斑块。用 A $\beta$  肽免疫的小鼠淀粉样斑块沉积显著减少<sup>[591]</sup>。B. 2 组淀粉样前体蛋白转基因小鼠的认知表现（记忆测试）。一组用无关蛋白免疫，另一组用 A $\beta$  肽免疫。接种 A $\beta$  的小鼠的表现水平接近正常动物，而接种无关蛋白的小鼠则表现出严重的记忆障碍<sup>[592]</sup>。

同样清楚的是，在大脑中，几种抗 A $\beta$  抗体结合可溶性或纤维状 A $\beta$ ，或两者结合。那些与聚集形式的 A $\beta$

结合的物质可以刺激小胶质细胞介导的吞噬作用以去除 A<sub>β</sub>，尽管也有不依赖于小胶质细胞介导的吞噬作用的斑块去除。进入大脑的可溶性 A<sub>β</sub> 抗体可能会降低可溶性 A<sub>β</sub> 的毒性。这些发现表明，免疫治疗策略可能在阿尔茨海默病患者中取得成功，特别是在疾病过程中、在出现严重神经元损伤和丢失之前尽早进行治疗。在临床前和轻度阿尔茨海默病中，正在进行多项针对 A<sub>β</sub> 的主动和被动免疫疗法的人体试验。

除了针对 A<sub>β</sub>，临床试验也开始针对 tau。这是通过针对 tau 的主动和被动免疫以及在细胞培养和动物模型中可以减少 tau 聚集的小分子来完成的。许多动物模型研究表明，某些抗 tau 抗体可以减少中枢神经系统中聚集的、过度磷酸化的 tau 蛋白的数量，并在某些情况下改善功能。虽然 tau 主要是一种细胞质蛋白，但抗 tau 抗体可能起作用的原因之一是，如上所述，tau 聚集体可能以类似朊病毒的方式在细胞外空间中从一个细胞扩散到另一个细胞。正是在这个空间中，抗体可能能够与 tau 相互作用并阻断这个过程。

## 64.6 要点

- 只是在过去的 50 年里，许多人能够活到活到 80 岁甚至更久。随着寿命的增加，神经科学家有机会深入研究正常衰老过程中的变化以及患有与年龄相关的脑部疾病的个体的大脑变化。
- 随着年龄的增长，人脑的多种功能会发生微妙的变化，包括处理速度和记忆存储的下降以及睡眠的变化。这些变化的根本原因可能是脑萎缩和白质完整性丧失。然而，总的来说，神经元数量并没有显著减少，这有助于我们理解在正常衰老过程中大脑功能变化的原因。
- 正常衰老过程中发生的认知变化不会致残。当记忆力和认知功能的其他区域随着年龄的增长而下降超出正常老化的预期，以至于其他人会注意到并轻度影响一个人的日常生活时，这种综合症称为轻度认知损伤。
- 轻度认知损伤不是一种疾病，它是一种综合症。大约 50% 的轻度认知损伤患者将阿尔茨海默病作为轻度认知损伤的根本原因。其他可能导致轻度认知损伤的情况包括抑郁症、脑血管疾病、路易体病、代谢紊乱，以及针对其他疾病开出的会引起中枢神经系统副作用的药物。
- 阿尔茨海默病是痴呆症最常见的原因，表现为记忆力和其他足以损害社会和职业功能的认知能力丧失。在美国，阿尔茨海默病约占痴呆病例的 70%，其余主要由脑血管疾病、帕金森和路易体痴呆以及额颞痴呆引起。
- 阿尔茨海默病的病理学特征是 2 种蛋白质 A<sub>β</sub> 肽和 tau 的聚集形式在大脑中的积累。A<sub>β</sub> 以纤维状形式积聚在脑实质和小动脉壁（称为脑淀粉样血管病）中的称为淀粉样斑块的细胞外结构中。Tau 在细胞体和树突中的神经原纤维缠结中积累。
- 在阿尔茨海默病中，除了大脑内蛋白质聚集体的累积外，随着疾病的进展，还会出现明显的脑萎缩以及突触和神经元丢失。还有强烈的神经炎症响应，特别是在小胶质细胞和星形胶质细胞的淀粉样斑块周围表现明显。
- 阿尔茨海默病的病理学在认知衰退或疾病的轻度认知损伤阶段之前约 15 年就开始了。新皮层中的 A<sub>β</sub> 积聚似乎以明显异常的水平引发疾病，随后 tau 聚集体从内侧颞叶扩散到新皮层的其他区域。症状出现之前的阿尔茨海默病病理学阶段称为临床前阿尔茨海默病。
- 重要数据表明，A<sub>β</sub> 肽的某些聚集形式会导致阿尔茨海默病大脑中的突触和神经元损伤，但与认知能力下降更好相关的是 tau 蛋白聚集形式的存在和积累。
- 阿尔茨海默病有 2 种主要形式。第一种是显性遗传性阿尔茨海默病（占阿尔茨海默病患者的比例不到 1%）是由编码蛋白质淀粉样前体蛋白、PS1 和 PS2 的 3 个基因之一的突变引起的；这种形式导致临床疾病在 30 到 50 岁之间发作。遗传、生物化学和其他研究表明，导致常染色体显性阿尔茨海默病的基因通过 A<sub>β</sub> 肽在大脑中的早期积累来实现。第二种形式，迟发性阿尔茨海默病，发病年龄为 65 岁或更晚，占病例的 99% 以上。虽然年龄是迟发性阿尔茨海默病的最大危险因素，但遗传因素也有影响。载脂蛋白 E 基因是迄今为止阿尔茨海默病的最大遗传因素，载脂蛋白 E4 变体增加风险，载脂蛋白 E2 变体降低风险。影响风险的其他基因中还有许多其他常见的遗传变异。其他基因（如 TREM2）中也存在罕见变异，这些变异将风险增加到与载脂蛋白 E4 一个拷贝相关的水平。尽管如此，普遍认为散发性和家族性阿尔茨海默病发病机制的主要特征相似。
- 除了阿尔茨海默病的临床症状和体征外，淀粉样蛋白和 tau 成像以及脑脊液标记物可以确定活人是否存在认知衰退的阿尔茨海默病症。

12. 目前，对于阿尔茨海默病，我们仅有的治疗方案主要是对症治疗，其效果只能带来适度的益处。许多影响 A $\beta$  或 tau 的产生、清除和聚集的潜在疾病缓解疗法正在人体中进行测试。尽管这些疗法尚未获得批准，但希望在未来几年内，其中一种或多种疗法能够证明具有显著的治疗效果。

### 专用名词中英对照表

| 英文 (缩略词)  | 中文                                 |
|---|------------------------------------|
| 11-cis retinal  | 11-顺式视黄醇                           |
| 1-Methyl-4-phenyl-1,2,3,<br>6-tetrahydropyridine (MPTP)                 | 焦磷酸甲基酯                             |
| 2-amino-5-phosphonovaleric<br>acid (APV)                                | 2-氨基-5-膦酰基缬草酸                      |
| 2-arachidonoylglycerol (2-AG)   | 2-花生酰基甘油                           |
| 3,4-methylenedioxy-N-methylamphetamine<br>(MDMA, ecstasy)               | 二亚甲基双氧安非他明, 摆头丸                    |
| 5 $\alpha$ -Reductase II deficiency                                     | 5 $\alpha$ -还原酶 2 缺乏症              |
| 5-hydroxyindoleacetic acid (5-HIAA)                                     | 5-羟基吲哚乙酸                           |
| 5-hydroxytryptophan (5-hydroxytryptamine, 5-HT)                         | 5-羟色氨                              |
| 5 $\alpha$ -Dihydrotestosterone (DHT)                                   | 5 $\alpha$ -二氢睾酮                   |
| 6-cyano-7-nitroquinoxaline-<br>2,3-dione (CNQX)                         | 6-氰基-7-硝基喹喔啉<br>-2,3-二酮            |
| 6-n-propyl-2-thiouracil (PROP)  | 6-丙基-2-硫代尿嘧啶                       |
| 7q11.23   | 第 7 号染色体<br>1 区 1 带<br>2 亚带 3 次亚带  |
| 8-hydroxy-diprolamino-tetraline<br>(8-OHDPAT)                           | 8-羟基-二丙醇氨基-四氢萘                     |
| $\alpha$ -amino-3-hydroxy-5-<br>methyl-4-isoxazolepropionic acid (AMPA) | $\alpha$ -氨基-3-羟基-5-<br>甲基-4-异恶唑丙酸 |
| $\alpha$ -melanocyte-stimulating hormone ( $\alpha$ -MSH)               | $\alpha$ -黑素细胞刺激素                  |
| $\gamma$ -aminobutyric acid (GABA)                                      | $\gamma$ -氨基丁酸                     |
| GABAB   | $\gamma$ -氨基丁酸 B 型                 |
| a disintegrin and metalloproteinase (ADAM)                              | 一种去整合蛋白和金属蛋白酶                      |
| A kinase attachment proteins  | A 型激酶锚定蛋白                          |
| Arvid Carlsson  | 阿尔维德·卡尔松                           |
| ABC1 transporter  | ABC 转运蛋白                           |
| Aaron Beck  | 亚伦·贝克                              |
| ATP-binding cassette transporter<br>(ABC transporter)                   | ATP 结合盒式转运蛋白                       |
| abdominals muscles (ABD)  | 腹肌                                 |

|                                       |               |
|---------------------------------------|---------------|
| abducens nerve (abducens)             | 外旋神经          |
| abducens nucleus                      | 外旋神经核         |
| abducens motor neurons                | 外旋运动神经元       |
| abduction                             | 外转（角膜向外的眼球运动） |
| abductor pollicis brevis (APB)        | 拇指展肌          |
| Abraham Lincoln                       | 亚伯拉罕·林肯       |
| absence epilepsy (absence seizure)    | 失神性癫痫         |
| absolute refractory period            | 绝对不应期         |
| accessory nerve                       | 副神经           |
| accessory olfactory bulb (AOB)        | 副嗅球           |
| accessory optic nuclei                | 视副核           |
| accessory optic system                | 辅助光学系统        |
| accommodation                         | 眼调焦           |
| acetylcholine (ACh)                   | 乙酰胆碱          |
| acetylcholinesterase (AChE)           | 乙酰胆碱酯酶        |
| Acetylcholine receptor (AChR)         | 乙酰胆碱受体        |
| acidosis                              | 酸中毒           |
| act                                   | 行为            |
| Actin, Actinin                        | 肌动蛋白          |
| action potential (AP)                 | 动作电位          |
| active sensing                        | 主动感知          |
| active transport                      | 主动运输          |
| active zone                           | 活性带           |
| activity-regulated cytoskeleton (ARC) | 活性调节的细胞骨架     |
| actor-critic (AC)                     | 参与者-评论家       |
| actuator                              | 执行器           |
| Adams                                 | 亚当斯           |
| Adaptor protein                       | 衔接蛋白          |
| Adenine (A)                           | 腺嘌呤           |
| adenosine triphosphate (ADP)          | 二磷酸腺苷         |
| adenosine triphosphatase              | 腺苷三磷酸酶        |
| adenosine triphosphatases (ATPase)    | 三磷酸腺苷酶        |
| adenosine triphosphate (ATP)          | 三磷酸腺苷         |

|                                    |             |
|------------------------------------|-------------|
| adeno-associated virus (AAV)       | 腺相关病毒       |
| adenylyl cyclase                   | 腺苷酸环化酶      |
| adduction                          | 内转          |
| adrenal cortex                     | 肾上腺皮质       |
| adrenal medulla                    | 肾上腺髓质       |
| adrenaline, epinephrine            | 肾上腺素        |
| adrenocorticotropic hormone (ACTH) | 促肾上腺皮质激素    |
| Adrian Garcia-Sierra               | 阿德里安·加西亚-塞拉 |
| affective aggression               | 情感性攻击       |
| affective disorder                 | 情感障碍        |
| affective neuroscience             | 情感神经科学      |
| afferent neuron                    | 传入神经元       |
| affordance                         | 功能可供性       |
| after-hyperpolarization            | 后超极化        |
| aggregate field theory             | 整合场理论       |
| agnosia                            | 失认症         |
| agonist–antagonist                 | 兴奋-拮抗       |
| agoraphobia                        | 广场恐怖症       |
| agoutirelated peptide (AgRP)       | 促食欲相关肽      |
| agrin                              | 聚集蛋白        |
| Alan Hodgkin                       | 艾伦·霍奇金      |
| Alanine                            | 丙氨酸         |
| Albany                             | 奥尔巴尼        |
| Alar plate                         | 翼板          |
| Albert Aguayo                      | 阿尔伯特·阿瓜约    |
| Albert Ellis                       | 阿尔伯特·埃利斯    |
| Alden Spencer                      | 奥尔登·斯宾塞     |
| Alexander Chesler                  | 亚历山大·切斯勒    |
| Alexander Luria                    | 亚历山大·卢力亚    |
| Alfred Kohn                        | 阿尔弗雷德·科恩    |
| Alison Adcock                      | 艾丽森·阿德科克    |
| Allan Rechtschaffen                | 艾伦·雷克尚芬     |
| alleles                            | 等位基因        |

|  |                |
|--|----------------|
| all-or-none  | 全有或全无          |
| all-trans retinal  | 全反式视黄醛         |
| alien hand syndrome (AHS)                                  | 异己手综合症         |
| Alois Alzheimer  | 阿尔茨海默          |
| alpha motor neuro  | $\alpha$ 运动神经元 |
| Altman   | 奥特曼            |
| Alzheimer disease (AD)                                     | 阿尔茨海默病         |
| Å  | 埃米             |
| Åke Vallbo   | 亚克·威尔波         |
| amacrine cell  | 无长突细胞          |
| Ameslan (ASL)  | 美国手语           |
| amino acid   | 氨基酸            |
| amino terminus ( $H_2N$ )                                  | 氨基末端           |
| Amiram Grinvald  | 阿米拉姆·格林弗德      |
| Ammon's horn   | 阿蒙角            |
| amnesia  | 遗忘症            |
| amnesiac gene  | 遗忘基因           |
| amnesic patients (AMN)                                     | 失忆症患者          |
| ampulla  | 壶腹             |
| amygdala; amygdaloid (Am)                                  | 杏仁核            |
| Amyloid neuropathy   | 淀粉样神经病变        |
| amyloid plaque   | 淀粉状蛋白斑         |
| amyloid precursor protein (APP)                            | 淀粉样前体蛋白        |
| amyotrophic lateral sclerosis<br>(ALS), Lou Gehrig disease | 肌萎缩侧索硬化        |
| anabolism  | 合成代谢           |
| anaclitic depression                                       | 依附性抑郁症         |
| anaerobic metabolism                                       | 无氧代谢           |
| analgesia  | 镇痛、痛觉缺失        |
| anandamide   | 大麻素            |
| Anatjari Tjampitjinpa                                      | 安纳塔里·詹皮金帕      |
| Anders Lundberg  | 安德斯·伦德伯格       |
| Andrew Huxley  | 安德鲁·赫胥黎        |
| Andrew Pruszynski  | 安德鲁·普鲁斯钦斯基     |

|  |           |
|--|-----------|
| Andrew Schally                         | 安德鲁·沙利    |
| androgens                              | 雄激素       |
| androstadienone (AND)                  | 雄二烯酮      |
| Andy Young                             | 安迪·杨      |
| anesthesia dolorosa                    | 痛性感觉缺失    |
| Angela Friederici                      | 安吉拉·弗里德里希 |
| Angelman Syndrome                      | 天使综合症     |
| angiogenin                             | 血管生成素     |
| angiotensin (ANG)                      | 血管紧张素     |
| angle of the foot in space             | 脚在空间中的角度  |
| anisomycin                             | 茴香霉素      |
| ankle jerk                             | 足踝反射      |
| ankle strategy                         | 脚踝策略      |
| ankyrin G (ankG)                       | 锚定蛋白 G    |
| annulus of Zinn                        | 总腱环       |
| Anopheles gambiae                      | 冈比亚疟蚊     |
| antennal lobe                          | 嗅叶        |
| anterior cingulate cortex (ACC)        | 前扣带皮层     |
| anterior commissure (AC)               | 前连合       |
| anterior insula (AI)                   | 前脑岛       |
| anterior intraparietal area (AIP)      | 前顶叶       |
| anterior lateral (AL)                  | 前外侧       |
| anterior thalamus (antTHAL)            | 前丘脑       |
| antisense oligonucleotides (ASO, ASOs) | 反义寡核苷酸    |
| anterior burster (AB)                  | 前部滑囊器     |
| Anterior commissure                    | 前连合       |
| anterior cranial fossa                 | 前颅窝       |
| anterior group                         | 前侧核群      |
| anterior medial                        | 前内侧       |
| anterior tibial muscle                 | 胫骨前肌      |
| anterograde amnesia                    | 顺行遗忘      |
| anterolateral system                   | 前外侧系统     |
| Anthony Movshon                        | 安东尼·莫夫松   |

|   |                      |
|---|----------------------|
| anticipatory control                            | 超前控制                 |
| antigravity muscles                             | 抗引力肌                 |
| Anxiety Sensitivity Index                       | 焦虑度                  |
| aortic arch                                     | 主动脉弓                 |
| Aplysia   | 海兔                   |
| Apperceptive agnosia                            | 统觉性失认症               |
| apolipoprotein E (ApoE, APOE)                   | 载脂蛋白 E               |
| apoptosis activating factor-1 (Apaf-1)          | 凋亡蛋白酶激活因子 1          |
| arachidonic acid                                | 花生四烯酸                |
| archaerhodopsin                                 | 古细菌视紫红质              |
| Area Under Curve (AUC)                          | 曲线下面积                |
| arcuate fasciculus                              | 弓状束                  |
| arcuate nucleus (ARC)                           | 弓状核                  |
| arcuate sulcus (AS)                             | 弓形沟                  |
| Ardem Patapoutian                               | 雅顿·帕塔普蒂安             |
| area postrema                                   | 延髓最后区                |
| Arginine (Arg)                                  | 精氨酸                  |
| aristaless related homeobox (ARX)               | Aristaless 相关同源异型盒基因 |
| Aristotle                                       | 亚里士多德                |
| arousal   | 觉醒                   |
| arrestin  | 抑制蛋白                 |
| Arthur Conan Doyle                              | 亚瑟·柯南·道尔             |
| Arthur Ewins                                    | 亚瑟·埃文斯               |
| Arthur Karlin                                   | 亚瑟·卡林                |
| Arvid Carlsson                                  | 阿尔维德·卡尔松             |
| AsbØrn FØlling                                  | 阿斯比约恩·佛林             |
| Ascending tract of Deiters                      | 戴特氏上行束               |
| aspartic acid (Asp)                             | 天冬氨酸                 |
| Asperger syndrome                               | 阿斯伯格综合症              |
| associative learning                            | 联想学习                 |
| Ataxin-1 (ATXN1)                                | 共济失调蛋白-1             |
| Ativan  | 劳拉西洋                 |
| Attention deficit hyperactivity disorder (ADHD) | 注意缺陷多动障碍             |

|   |                    |
|---|--------------------|
| attractant response   | 引诱响应               |
| Augustus Waller   | 奥古斯都·沃勒            |
| autism spectrum disorder (ASD)                              | 孤独症谱系障碍            |
| autistic savant   | 孤独症学者              |
| autobiographical memory                                     | 自传式记忆              |
| autonomic nervous system                                    | 自主神经系统             |
| autonomic regulation  | 自动管控               |
| autonomous control  | 自动控制               |
| autophagy   | 自体吞噬泡              |
| autosomal dominant (AD)                                     | 常染色体显性             |
| autosomal dominant nocturnal frontal lobe epilepsy (ADNFLE) | 常染色体显性遗传<br>夜间额叶癫痫 |
| autosomal recessive (AR)                                    | 常染色体隐性             |
| axolemma (Al)   | 轴突膜                |
| Axonal transport  | 轴突运输               |
| axoplasmic flow   | 轴浆流                |
| axo-axonic synapse  | 轴-轴突触              |
| Babinski sign   | 巴彬斯基症              |
| backward masking  | 逆向掩蔽               |
| Balint syndrome   | 巴林特综合症             |
| banded krait (Bungarus)                                     | 金环蛇                |
| barn owl  | 仓鸮                 |
| Barnes maze   | 巴恩斯迷宫              |
| Barrel cortex   | 桶状皮层               |
| Barrington's nucleus  | 丘脑前核群              |
| Barto   | 巴托                 |
| Baptists  | 浸礼宗                |
| basal ganglia   | 基底神经节              |
| basal ganglia nuclei  | 基底核                |
| basal nucleus of Meynert (BM)                               | 迈纳特基底核             |
| basal plate   | 基板                 |
| Basal temporal  | 基底颞叶               |
| base of support   | 脚间距离               |
| Base Pair (bp)  | 碱基对                |

|  |                 |
|--|-----------------|
| basic helix-loop-helix (bHLH)              | 碱性螺旋环螺旋         |
| basilar artery                             | 基底动脉            |
| Basis pedunculi                            | 基脚              |
| basket cell                                | 篮状细胞            |
| Bayesian inference                         | 贝叶斯推理           |
| Bayes Rule                                 | 贝叶斯公式           |
| Beck Anxiety Inventory                     | 贝克焦虑问卷          |
| Becker muscular dystrophy                  | 贝克肌营养不良         |
| bed nucleus of the stria terminalis (BNST) | 终纹床核            |
| behavior development                       | 行为发育            |
| Bell palsy                                 | 贝尔面瘫            |
| Bell phenomenon                            | 贝尔现象            |
| Ben Barres                                 | 本·巴瑞斯           |
| Bengt Falck                                | 本特·法尔克          |
| Benjamin Brodie                            | 本杰明·布罗迪         |
| Benjamin Libet                             | 本杰明·李贝特         |
| Benoni Edin                                | 贝诺尼·爱丁          |
| benzodiazepines                            | 苯二氮卓类           |
| Bernard Katz                               | 伯纳德·卡茨          |
| Bert Sakmann                               | 伯特·萨克曼          |
| Bertil Hille                               | 贝蒂尔·希勒          |
| Best Frequency (BF)                        | 最佳频率            |
| Bethlem myopathy                           | 贝斯勒姆肌病          |
| biceps brachii                             | 肱二头肌            |
| bimodal neuron                             | 双模态神经元          |
| biochemical cascade                        | 生化级联响应          |
| Bithorax complex                           | 双胸复合体           |
| blastopore                                 | 胚孔              |
| blastopore lip                             | 胚孔唇             |
| blastula                                   | 囊胚              |
| BMAL1                                      | 脑和肌肉芳烃受体核转位蛋白 1 |
| blood gases                                | 血气              |
| body angle relative to the foot (BF)       | 身体相对于脚的角度       |

|  |                              |
|--|------------------------------|
| body tilt with respect to earth vertical or body-in-space (BS) | 身体相对于地球<br>垂直倾斜或身体<br>在空间中倾斜 |
| bone morphogenetic protein (BMP)                               | 骨形态发生蛋白                      |
| bone morphogenetic protein receptors (BMPR)                    | 骨形态发生蛋白受体                    |
| bone remodeling  | 骨重建                          |
| Blood Oxygen-Level Dependent (BOLD)                            | 血氧水平依赖                       |
| border cell  | 边界细胞                         |
| brachioradialis (BR)   | 肱桡肌                          |
| brachium pontis (BP)   | 脑桥臂                          |
| bradykinin (BK)  | 缓激肽                          |
| Brahms   | 勃拉姆斯                         |
| brain derived neurotrophic factor (BDNF)                       | 脑源性神经营养因子                    |
| BRAIN Initiative   | 脑计划                          |
| brain stem (BS)  | 脑干                           |
| branchial arch   | 鳃弓                           |
| Brenda Milner  | 布伦达·米尔纳                      |
| British Sign Language (BSL)                                    | 英国手语                         |
| Broca's aphasia  | 布洛卡失语症                       |
| Brodmann area (Cg25)   | 布罗德曼 25 区                    |
| Brody myopathy   | 布罗迪肌病                        |
| Bror Alstermark  | 布鲁尔·阿尔斯特马克                   |
| brown adipose tissue   | 棕色脂肪组织                       |
| Bruckner   | 布鲁克纳                         |
| Bruner   | 布鲁纳                          |
| Bruniger   | 布伦杰                          |
| Bulbocavernosus muscle   | 球海绵体肌                        |
| bulk concentration   | 本体浓度                         |
| Bungarus multicinctus  | 银环蛇                          |
| Burke  | 伯克                           |
| burst cell   | 爆发细胞                         |
| bushy cell   | 多毛细胞                         |
| B-cell lymphoma-2 (Bcl-2)                                      | B 细胞淋巴瘤-2 基因                 |

|   |                                |
|---|--------------------------------|
| B. F. Skinner   | 斯金纳                            |
| Caenorhabditis elegans (C. elegans)                           | 秀丽隐杆线虫                         |
| Cajal-Retzius cells   | 卡-雷氏细胞                         |
| calcitonin gene-related peptide (CGRP)                        | 降钙素基因相关肽                       |
| Calcium-calmodulin (CaM)-dependent protein kinase II (CaMKII) | 钙/钙调蛋白<br>依赖性蛋白激酶 2            |
| calmodulin (CaM)  | 钙调蛋白                           |
| calyceal ending   | 花萼末梢                           |
| Calyx of Held   | 花萼突触                           |
| Camillo Golgi   | 卡米洛·高尔基                        |
| cAMP response element (CRE)                                   | 环磷酸腺苷应答元件                      |
| cAMP response element binding protein (CREB)                  | 环磷酸腺苷应答元件<br>结合蛋白              |
| canal signals   | 半规管信号                          |
| candy stripe  | 肯特直条纹                          |
| Cannon-Bard   | 坎农-巴德                          |
| Canonical babbling  | 咿呀学语                           |
| canonical splice site mutation                                | 经典剪切位点突变                       |
| Capgras Syndrome  | 替身综合症                          |
| Capicua (CIC)   | Capicua 转录阻抑蛋白                 |
| Carandini   | 卡兰迪尼                           |
| carboxy terminus (COOH)                                       | 羧基末端                           |
| Carl Olson  | 卡尔·奥尔森                         |
| Carl Wernicke   | 卡尔·韦尼克                         |
| carotid sinus   | 颈动脉窦                           |
| cartwheel cell  | 车轮细胞                           |
| casein-1 kinase epsilon or delta                              | 酪蛋白-1 激酶 $\epsilon$ 或 $\delta$ |
| Caspase   | 半胱天冬酶                          |
| catalytic subunit (C)   | 催化亚基                           |
| catechol-O-methyltransferase (COMT)                           | 儿茶酚氧位甲基转移酶                     |
| categorical perception  | 分类知觉                           |
| catenin   | 连环蛋白                           |
| caudate (CD)  | 尾核                             |
| Caveolin  | 凹陷蛋白                           |

|                                   |          |
|-----------------------------------|----------|
| Cavernous sinus                   | 海绵窦      |
| CB1 cannabinoid receptors         | 大麻素受体    |
| Ced-9                             | 抗凋亡基因    |
| Ced-9 protein                     | 抗凋亡蛋白    |
| cell assembly                     | 细胞集合     |
| cell death (ced)                  | 细胞死亡     |
| cell line                         | 细胞系      |
| center of mass (CoM)              | 质心       |
| center of pressure (CoP)          | 压力中心     |
| central autonomic network         | 中枢自主神经网络 |
| central brain                     | 中央脑      |
| central chemoreceptor             | 中枢化学感受器  |
| central core disease              | 中央轴空病    |
| central gray region (CG)          | 中央灰质区    |
| central nervous system (CNS)      | 中枢神经系统   |
| central neuron                    | 中枢神经元    |
| central nucleus                   | 中央核      |
| central pattern generators (CPGs) | 中枢模式发生器  |
| central visual pathway            | 中枢视觉通路   |
| centromere                        | 着丝粒      |
| Cephalic flexure                  | 头曲       |
| cerebellar folia                  | 小脑小叶     |
| cerebellar flocculus              | 小脑小叶     |
| cerebellar glomerulus             | 小脑小球     |
| cerebellar lobule                 | 小脑小叶     |
| cerebellar nuclei                 | 小脑核      |
| cerebellar peduncle               | 小脑脚      |
| cerebellar tract                  | 小脑束      |
| cerebellopontine angle (CPA)      | 桥小脑角区    |
| cerebral amyloid angiopathy (CAA) | 脑淀粉样血管病变 |
| cerebral peduncle (CP)            | 大脑脚      |
| cerebrospinal fluid (CSF)         | 脑脊液      |
| cerebrum                          | 大脑       |

|   |             |
|---|-------------|
| Cervical flexure                          | 颈曲          |
| Cervical ventral roots                    | 颈腹根         |
| cGMP-dependent protein kinase (PKG)       | 环磷酸腺苷依赖蛋白激酶 |
| Ch group                                  | 胆碱能组        |
| chance level                              | 机会水平        |
| chandelier cell                           | 吊灯细胞        |
| change blindness                          | 变化盲         |
| channelopathies                           | 离子通道病       |
| channelrhodopsin-2                        | 光敏感通道蛋白     |
| chaperone                                 | 伴侣蛋白        |
| Chaperone proteins                        | 伴侣蛋白        |
| Characteristic Deficit                    | 典型缺陷        |
| Charcot-Leyden crystal (CLC) protein      | 夏科雷登氏结晶蛋白   |
| Charcot-Marie-Tooth disease (CMT)         | 腓骨肌萎缩症      |
| Charles Bell                              | 查尔斯·贝尔      |
| Charles Bonnet                            | 查尔斯·庞奈      |
| Charles Darwin                            | 查尔斯·达尔文     |
| Charles F. Stevens                        | 查尔斯·史蒂芬斯    |
| Charles Gilbert                           | 查尔斯·吉尔伯特    |
| Charles Gross                             | 查尔斯·格罗斯     |
| Charles Sherrington                       | 查尔斯·谢林顿     |
| Chemoattractant                           | 化学引诱物       |
| Chemorepellent                            | 化学排斥物       |
| Cheyne-Stokes respiration                 | 潮式呼吸        |
| Chiara Cirelli                            | 基娅拉·奇雷利     |
| chinchillas                               | 毛丝鼠         |
| Chippendale side chair                    | 奇彭代尔式侧椅     |
| Cholecystokinin (CCK)                     | 胆囊收缩素       |
| choline (Ch)                              | 胆碱          |
| choline acetyltransferase (ChAT)          | 胆碱乙酰转移酶     |
| choline transporter (CHT)                 | 胆碱转运蛋白      |
| chondriosome hexokinase (MthK)            | 线粒体己糖激酶     |
| Chondroitin sulphate proteoglycans (CSPG) | 硫酸软骨素蛋白多糖   |

|  |              |
|--|--------------|
| Chorda tympani nerve   | 鼓索神经         |
| chordin  | 脊索发生素        |
| Chorea-acanthocytosis  | 舞蹈病          |
| choroid plexus (CP)  | 脉络丛          |
| Christopher Koch   | 克里斯托弗·科赫     |
| Christopher Koch   | 克里斯托弗·米勒     |
| chromaffin cell  | 嗜铬细胞         |
| chromosomal sex  | 染色体性别        |
| chronic traumatic encephalopathy (CTE)                             | 慢性创伤性脑病      |
| cigar-shaped   | 雪茄形          |
| ciliary neurotrophic factor (CNTF)                                 | 睫状神经营养因子     |
| cingulate motor areas (CMA, CMar)                                  | 扣带运动区        |
| cisterns   | 脑池           |
| Claude Bernard   | 克劳德·伯纳德      |
| Clark Hull   | 克拉克·赫尔       |
| Clay Armstrong   | 克莱·阿姆斯特朗     |
| Climbing fiber (CF)  | 攀缘纤维         |
| Clinton Woolsey  | 克林顿·伍尔西      |
| Clive Waring   | 克里夫·韦林       |
| clock gene   | 时钟基因         |
| CLOCK protein (CLOCK)  | 时钟蛋白         |
| Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) | 规律成簇的间隔短回文重复 |
| cm Hg  | 厘米汞柱         |
| coat protein I   | 衣被蛋白 I       |
| Coated pit   | 包被小窝         |
| Cocaine- and amphetamineregulated transcript (CART)                | 可卡因和苯丙胺调节转录物 |
| cochlear duct  | 耳蜗管          |
| Cochlear Nucleus(cochlear nuclei, CN)                              | 耳蜗核          |
| codeine  | 可待因          |
| cognitive map  | 认知地图         |
| Commissural fibers   | 连合纤维         |
| commissural interneurons (CIN)                                     | 连合中间神经元      |

|   |              |
|---|--------------|
| commissural neuron                              | 连合神经元        |
| compartments                                    | 区室           |
| compensatory response                           | 补偿响应         |
| Complement factor 3b (C3b)                      | 补体因子 3b      |
| Complement factor 4 (C4)                        | 补体因子 4       |
| complementary DNA (cDNA)                        | 互补脱氧核糖核酸     |
| Complete androgen insensitivity syndrome (CAIS) | 完全型雄激素不敏感综合症 |
| complete serial compound (CSC)                  | 全串行复合        |
| compound muscle action potential (CMAP)         | 复合肌肉动作电位     |
| computed tomographic (CT)                       | 计算机断层扫描      |
| conditioned response (CR)                       | 条件反射         |
| conditioned stimulus (CS)                       | 条件刺激         |
| conduction aphasia                              | 传导性失语症       |
| Congenital myopathy                             | 先天性肌病        |
| connectional specificity                        | 连接特异性        |
| Constantin von Economo                          | 康斯坦丁·冯·艾克诺   |
| Constant-Frequency (CF)                         | 恒频           |
| cone cell                                       | 视锥细胞         |
| Congenital adrenal hyperplasia (CAH)            | 先天性肾上腺皮质增生症  |
| Congenital muscular dystrophy                   | 先天性肌营养不良     |
| coincidence detector                            | 同时发生探测器      |
| congenital sensory neuropathy                   | 先天性感觉性神经病变   |
| conjugate eye movement                          | 双眼同向运动       |
| conjunctive cell                                | 联合细胞         |
| connectome                                      | 连接组          |
| connexin-32 (Cx32)                              | 连接蛋白 32      |
| conscious awareness                             | 意识觉知         |
| Contactin                                       | 接触蛋白         |
| contactin-associated protein-like 2 (Caspr2)    | 接触蛋白相关蛋白 2   |
| context   | 背景           |
| continuous positive airway pressure (CPAP)      | 持续气道正压       |
| contralateral neglect                           | 对侧空间忽视症      |

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|--|-----------------|
| copy number variation (CNV)                          | 拷贝数变异           |
| convergence  | 汇聚              |
| Cornelis Cornelisz van Haarlem                       | 科内利斯·科内利兹·凡·哈勒姆 |
| cornu Ammonis (CA)                                   | 阿蒙角             |
| corollary discharge                                  | 伴随发送            |
| coronal plane  | 冠状面             |
| corona radiata                                       | 辐射冠             |
| corpus callosum                                      | 胼胝体             |
| correct rejection                                    | 正确否定            |
| Corso Cotugno  | 科索·科图加诺         |
| cortical; cortex                                     | 皮层              |
| cortical plate (CP)                                  | 皮层板             |
| corticomedullary (CM)                                | 皮层运动神经          |
| corticospinal tract (CST)                            | 皮层脊髓束           |
| corticotropin-like intermediate-lobe peptide (CLIP)  | 促皮质激素样中间肽       |
| Corticotropin-releasing factor (CRF)                 | 促皮质素释放因子        |
| Corti's organ  | 柯蒂氏器            |
| corticotropin-releasing hormone (CRH)                | 促肾上腺皮质激素释放激素    |
| cotransmitter  | 辅助递质            |
| cotranslational transfer                             | 翻译转运同步机制        |
| CO <sub>2</sub> partial pressure (PCO <sub>2</sub> ) | 二氧化碳分压          |
| CREB binding protein (CBP)                           | 环磷酸腺苷应答元件结合蛋白   |
| Craig Barclay  | 克雷格·巴克莱         |
| cranial nerve  | 颅神经             |
| creatine phosphokinase (CPK)                         | 肌酸磷酸激酶          |
| Creutzfeldt-Jakob disease                            | 克雅病             |
| crocodile tears                                      | 鳄鱼的眼泪           |
| cryptochrome gene (cry)                              | 隐花色素基因          |
| Crystallin   | 晶体蛋白            |
| Cribiform plate                                      | 筛板              |
| cross bridge   | 交叉桥             |
| cue's location (PD)                                  | 提示方向            |
| cuneiform nucleus (CNF)                              | 楔形核             |

|   |               |
|---|---------------|
| cupula  | 壶腹帽           |
| current receptive field (CRF)                                 | 当前感受野         |
| current sink  | 电流阱           |
| Cuticular plate   | 膜状板           |
| Cu-Zn superoxide dismutase                                    | 铜-锌超氧化物歧化酶    |
| cyclic adenosine monophosphate (cAMP)                         | 环磷酸腺苷         |
| cyclic amino acids tyrosine                                   | 环状氨基酸酪氨酸      |
| cyclic guanosine<br>3 ,5 -monophosphate (cGMP)                | 环鸟苷-3,5-单磷酸盐  |
| cyclic nucleotide-gated channel                               | 环核苷酸门控离子通道    |
| cycloheximide (CYX)   | 环己酰亚胺         |
| cyclooxygenase (COX)  | 环氧化酶          |
| cys-loop receptor   | 半胱氨酸-环受体      |
| Cys-S-S-Cys   | 二硫键           |
| cytochrome P450 complex                                       | 细胞色素 P450     |
| cytomegalovirus   | 巨细胞病毒         |
| cytoplasmic polyadenylation element<br>(CPE)                  | 胞质聚腺苷酸化元件     |
| cytoplasmic polyadenylation element<br>binding protein (CPEB) | 胞质聚腺苷酸化元件结合蛋白 |
| cytosine (C)  | 胞嘧啶           |
| cytosine-adenine-guanine (CAG)                                | 胞嘧啶-腺嘌呤-鸟嘌呤   |
| C. Miller Fisher  | 米勒·费雪         |
| c-Jun N-terminal kinase (JNK)                                 | c-Jun 氨基末端激酶  |
| Dab1  | 磷脂蛋白受体 Dab1   |
| Dahlstrom   | 达尔斯特伦         |
| Dalton (Da)   | 道尔顿           |
| Daniel L. Yamins  | 丹尼尔·亚明斯       |
| Daniel Wolpert  | 丹尼尔·沃普特       |
| Daniela Perani  | 丹妮拉·佩拉尼       |
| Danielle Bassett  | 丹妮尔·巴西特       |
| dart and dome   | 圆顶尖角          |
| David Freedman  | 大卫·弗雷德曼       |
| David Ferrier   | 大卫·费里尔        |

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|--|--------------------------|
| David Hubel  | 大卫·休伯尔                   |
| David Hume   | 大卫·休谟                    |
| David Ginty  | 大卫·金蒂                    |
| David Julius   | 大卫·朱利斯                   |
| David Lloyd  | 大卫·劳埃德                   |
| David Marr   | 大卫·马尔                    |
| David McCormick  | 大卫·麦考密克                  |
| David Milner   | 大卫·米尔纳                   |
| David Poeppel  | 大卫·波佩尔                   |
| David Potter   | 大卫·波特                    |
| David Prince   | 大卫·王子                    |
| David Rosenthal  | 大卫·罗森萨尔                  |
| DaVinci stereopsis   | 达芬奇立体视觉                  |
| de novo mutation   | 新生突变                     |
| Deborah Mills  | 黛博拉·米尔斯                  |
| decerebrate animal   | 去脑动物                     |
| decerebration  | 大脑切除术                    |
| decision   | 决策                       |
| deep brain stimulation (DBS)                                       | 深部脑刺激                    |
| deep cerebellar nucleus (DCN)                                      | 小脑深部核团                   |
| Deep pressure  | 深压                       |
| Degenerine (DEG)   | 退化蛋白                     |
| Deiters's cell   | 戴特氏细胞                    |
| Deiters' nucleus   | 戴特氏核                     |
| Dejerine-Roussy syndrome   | 丘脑综合征；德热里纳-鲁西综合症         |
| Dejerine-Sottas infantile neuropathy<br>(Dejerine-Sottas Syndrome) | 肥大性神经炎，<br>德热里纳-索塔斯婴儿神经病 |
| Del Castillo   | 德尔·卡斯蒂略                  |
| delay eyeblink conditioning  | 延迟性眨眼条件反射                |
| delayed-match-to-sample (DMS)                                      | 延迟样本匹配                   |
| deleted in colon cancer (DCC)                                      | 结直肠癌缺失                   |
| delirium   | 神志失常                     |
| denatonium (DEN)   | 苯甲地那铵                    |
| dentate gyrus (DG)   | 齿状回                      |

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| dentate nucleus  | 齿状核                |
| dentate region   | 齿状区                |
| dentatorubro-pallidolusian atrophy (DRPLA)                                   | 齿状核红核苍白球路易体萎缩症     |
| DeoxyriboNucleic Acid (DNA)  | 脱氧核糖核酸             |
| Depakote   | 丙戊酸钠               |
| depression, infraduction   | 下转 (角膜向下的眼球运动)     |
| derealization  | 现实感丧失              |
| descending vestibular nucleus  | 前庭神经下核             |
| designer receptors exclusively activated by designer drugs (DREADDs)         | 设计药物激活的设计受体        |
| desmin   | 肌间线蛋白              |
| Desmin storage myopathy  | 肌间线蛋白储存性肌病         |
| desmosomal junction  | 桥粒样连接              |
| dexamethasone  | 地塞米松               |
| de-repressor   | 去阻遏物               |
| diacylglycerol (DAG)   | 甘油二酯               |
| diacylglycerol lipase (DAGL)   | 二酰基甘油脂酶            |
| Diagnostic and Statistical Manual of Mental Disorders                        | 《精神疾病诊断和统计手册》      |
| Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) | 《精神疾病诊断和统计手册(第五版)》 |
| diagonal band  | 斜角带                |
| Diana Bautista   | 戴安娜·保蒂斯塔           |
| diffuse bipolar cell (DB)  | 弥散双极细胞             |
| diffusion tensor imaging (DTI)   | 弥散张量成像             |
| digastric muscle   | 二腹肌                |
| DiGeorge syndrome  | 迪格奥尔格综合症           |
| Dilantin   | 苯妥英钠               |
| Distal myofibrillar myopathy   | 远端肌纤维性肌病           |
| distortion-product otoacoustic emissions                                     | 畸变产物耳声发射           |
| DMD  | 进行性肌营养不良症          |
| Dominic ffytche  | 多米尼克·费切            |
| sexually dimorphic behavior  | 性二态行为              |

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| Donald Hebb                                      | 唐纳德·赫布     |
| Donald Humphrey                                  | 唐纳德·汉弗莱    |
| Donald Rudin                                     | 唐纳德·鲁丁     |
| dopamine transporter (DAT)                       | 多巴胺转运蛋白    |
| Doppler-shifted constant-frequency (DSCF)        | 多普勒频移恒频    |
| Doris Tsao                                       | 曹颖         |
| dorsal anterior cingulate cortex (dACC)          | 背前扣带皮层     |
| dorsal caudate nucleus (dCN)                     | 背侧尾核       |
| dorsal cochlear nucleus                          | 耳蜗背核       |
| dorsal column nuclei                             | 脊髓背根核      |
| dorsal lip                                       | 背唇         |
| dorsal premotor cortex (PMd)                     | 背侧前运动皮层    |
| dorsal raphe (DR)                                | 中缝背核       |
| dorsal root ganglion (DRG)                       | 背根神经节      |
| dorsal spinocerebellar tract (DSCT)              | 脊髓小脑背侧束    |
| dorsolateral prefrontal cortex (DLPFC, F9)       | 背外侧前额叶皮层   |
| dorsolateral striatum (DLS)                      | 背外侧纹状体     |
| dorsomedial prefrontal cortex (DMPFC)            | 背内侧前额叶皮层   |
| dorsomedial nucleus of<br>the hypothalamus (DMH) | 下丘脑背内侧核    |
| dorsomedial striatum (DMS)                       | 背内侧纹状体     |
| dorsomedial thalamus (dmTHAL)                    | 背内侧丘脑      |
| double dissociation                              | 双分离        |
| doublecortin                                     | 双皮质素       |
| dorsiflex  | 背屈         |
| Dorsum sellae                                    | 鞍背         |
| Douglas Coleman                                  | 道格拉斯·科尔曼   |
| Down syndrome                                    | 唐氏综合症      |
| Doxycycline                                      | 多西环素       |
| Dravet syndrome                                  | 婴儿严重肌阵挛性癫痫 |
| Drosophila melanogaster                          | 黑腹果蝇       |
| ductus reuniens                                  | 黑腹果蝇       |
| dumb gene  | 哑巴基因       |
| dunce gene                                       | 低能学生基因     |

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|---------------------------------|-------------|
| dynactin                        | 动力肌动蛋白      |
| Dynactin subunit 1              | 动力肌动蛋白亚单位 1 |
| dynein                          | 动力蛋白        |
| Dynorphin                       | 强啡肽         |
| dysarthria                      | 构音障碍        |
| dysdiadochokinesia              | 轮替运动障碍      |
| dysphagia                       | 吞咽困难        |
| dystonia                        | 肌张力障碍       |
| Duchenne                        | 杜氏营养不良症     |
| Dura                            | 硬脑膜         |
| dystroglycan                    | 肌营养不良蛋白聚糖   |
| Earl Miller                     | 厄尔·米勒       |
| echo planar imaging (EPI)       | 平面回波成像      |
| electrotonic transmission       | 电紧张传输       |
| Ed Evarts                       | 埃德·埃瓦茨      |
| Edgar Adrian                    | 埃德加·阿德里安    |
| Edinger-Westphal nucleus        | 动眼神经副核      |
| edrophonium                     | 腾喜龙         |
| Eduard Hitzig                   | 爱德华·希茨格     |
| Edward Albert Schaefer          | 爱德华·艾伯特·谢弗  |
| Edward Evarts                   | 爱德华·埃瓦茨     |
| Edwin Furshpan                  | 爱德华·弗斯潘     |
| Edward Krebs                    | 爱德华·克雷布     |
| Edward Lee Thorndike            | 爱德华·李·桑代克   |
| Edward Tolman                   | 爱德华·托尔曼     |
| Edwin Landolt                   | 爱德华·兰德      |
| Edvard Moser                    | 爱德华·莫泽      |
| Edward Purcell                  | 爱德华·珀塞尔     |
| efference copy                  | 传出副本        |
| egg-laying hormone (ELH)        | 产卵激素        |
| elastin (ELN)                   | 弹性蛋白        |
| Eleanor Roosevelt               | 埃莉诺·罗斯福     |
| electroconvulsive therapy (ECT) | 电痉挛疗法       |

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| electrocorticography (ECoG)                | 脑皮层电图          |
| electroencephalogram (EEG)                 | 脑电图            |
| electromyogram (EMG)                       | 肌电图            |
| electromotive force (EMF)                  | 电动势            |
| electroneurogram                           | 神经电图           |
| electroplaques                             | 电板             |
| electrotonic potential                     | 电紧张电位          |
| electro-oculogram (EOG)                    | 眼电图            |
| elevation, supraduction                    | 上转（角膜向上的眼球运动）  |
| Ellen Lumpkin                              | 艾伦·伦普金         |
| Elwood Henneman                            | 埃尔伍德·亨尼曼       |
| emboliform nucleus                         | 栓状核            |
| emergent property                          | 涌现特性           |
| Emetine                                    | 吐根碱            |
| embryogenesis                              | 胚胎形成           |
| embryonic stem (ES)                        | 胚胎干细胞          |
| Emerin                                     | 伊默菌素           |
| Emery-Dreifuss muscular dystrophy          | 埃默里-德赖弗斯肌营养不良  |
| Emil du Bois-Reymond                       | 埃尔米尔·杜·博伊斯·雷蒙德 |
| Emil Kraepelin                             | 埃尔米尔·克雷佩林      |
| emotional valence                          | 情绪效价           |
| empty spiracles homeobox 2 ( <b>Emx2</b> ) | 空通气孔同源物 2      |
| Endel Tulving                              | 安道尔·图威         |
| endocytic traffic                          | 胞吞运输           |
| Endoplasmic reticulum                      | 内质网            |
| Endorphin                                  | 内啡肽            |
| end-foot                                   | 终足             |
| Engrailed                                  | 齿状基因片段         |
| engram                                     | 记忆的痕迹          |
| enhanced green fluorescent protein (eGFP)  | 增强型绿色荧光蛋白      |
| enhancer box (E-box)                       | 增强盒            |
| entopeduncular nucleus                     | 脚内核            |
| entorhinal cortex (Ent)                    | 内嗅皮层           |

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| enzyme horseradish peroxidase            | 辣根过氧化物酶      |
| Ephrin type-B receptor 6 (EphB6)         | 酪氨酸蛋白激酶受体 B6 |
| Ephrins                                  | 轴突导向因子       |
| epicritic system                         | 精细觉系统        |
| epidermal cell                           | 表皮细胞         |
| epidermal growth factor (EGF)            | 表皮细胞生长因子     |
| Epidermolysis bullosa simplex            | 单纯性大疱性表皮松解症  |
| Epimerase                                | 差向异构酶        |
| episodic memory                          | 情景记忆         |
| epithelial sodium channels (ENaC)        | 上皮钠离子通道      |
| equivalent genes                         | 等价基因         |
| Eric Gouaux                              | 埃里克·古奥       |
| Eric Lenneberg                           | 埃里克·勒纳伯格     |
| Ernst Brücke                             | 能斯特·布吕克      |
| Ernst equation                           | 能斯特方程        |
| Ernst equation                           | 能斯特·韦伯       |
| Erwin Neher                              | 厄温·内尔        |
| euchromatin                              | 常染色质         |
| eukaryote                                | 真核生物         |
| Eustachian tube                          | 咽鼓管          |
| Evan Eichler                             | 埃文·艾克勒       |
| estratetraenol (EST)                     | 雌四烯醇         |
| ethyl methanesulfonate (EMS)             | 甲磺酸乙酯        |
| Eugene Aserinsky                         | 尤金·阿瑟林斯基     |
| excitatory interneurons (EN)             | 兴奋性中间神经元     |
| Excitatory postsynaptic currents (EPSCs) | 兴奋性突触后电流     |
| Excitatory PostSynaptic Potential (EPSP) | 兴奋性突触后电位     |
| Excited-Excited neuron (EE neuron)       | 双耳兴奋神经元      |
| Excited-Inhibited neuron (EI neuron)     | 兴奋-抑制神经元     |
| executive control processes              | 执行控制过程       |
| experience sampling                      | 经验采样         |
| explicit memory                          | 外显记忆         |
| Extended Kalman Filter (EKF)             | 扩展卡尔曼滤波器     |

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| extensor digitorum (ED)                                   | 伸指肌           |
| external globus pallidus (GPe)                            | 外侧苍白球         |
| external segment  | 外侧部           |
| extorsion   | 外旋            |
| extracellular signal-regulated kinase                     | 细胞外信号调节激酶     |
| extrapyramidal motor system                               | 锥体外运动系统       |
| Extrastriate  | 纹外皮层          |
| extrastriate body area (EBA)                              | 纹外体区域         |
| extrinsic reinforcement                                   | 外部强化          |
| eyelid  | 眼睑            |
| eyelid conditioning                                       | 眼睑条件反射        |
| Falk  | 福尔克           |
| false alarm   | 误警            |
| false negative (FN)                                       | 假负            |
| false negative (FN)                                       | 假负            |
| False Positive (FP)                                       | 假正            |
| false-positive rate (FPR)                                 | 假阳性率          |
| familial advanced sleep-phase syndrome                    | 家族性睡眠时相提前综合症  |
| farnesyl  | 法尼基           |
| Fas Associating Death Domain<br>Containing Protein (FADD) | 含 Fas 关联死亡域蛋白 |
| fast ripples  | 快涟波           |
| fastigial nucleus (FN)                                    | 顶核            |
| Fechner   | 费希纳           |
| feedback control  | 反馈控制          |
| Felix Bloch   | 费利克斯·布洛赫      |
| Fergus Craik  | 弗格斯·克雷克       |
| Fernando Tello-Muñoz                                      | 费尔南多·特略-穆诺兹   |
| fiber tract   | 纤维束           |
| fibrillation  | 纤维震颤          |
| fibroblast growth factor (FGF)                            | 成纤维细胞生长因子     |
| fibrous astrocyte   | 纤维性星形胶质细胞     |
| fictive locomotion  | 虚拟移动          |

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| field excitatory                         | 兴奋性突触后电位场 |
| postsynaptic potential (fEPSP)           |           |
| filopodia                                | 线状伪足      |
| fimbria                                  | 海马伞       |
| firing field                             | 激活场       |
| firing rate                              | 激活率       |
| fixation point                           | 注视点       |
| flexion                                  | 弯曲        |
| flexor carpi ulnaris (FCU)               | 尺侧腕屈肌     |
| flocculonodular lobe                     | 绒球小结叶     |
| floor plate (FP)                         | 底板        |
| florbetaben                              | 氟比他班      |
| florbetapir                              | 洛贝平       |
| Fluorescent false neurotransmitter (FFN) | 荧光假神经递质   |
| flutemetamol                             | 富特米他      |
| flutter-vibration task                   | 震动任务      |
| focal damage                             | 局灶性损伤     |
| Focal onset                              | 局灶性起源     |
| Focal seizure                            | 局灶性癫痫发作   |
| fucose                                   | 岩藻糖       |
| follicle-stimulating hormone (FSH)       | 卵泡刺激素     |
| follistatin                              | 卵泡抑素      |
| forebrain                                | 前脑        |
| form agnosia                             | 形状失认症     |
| formant frequencies                      | 共振峰频率     |
| foraging gene                            | 觅食基因      |
| formyl peptide-related receptors (FPRs)  | 甲酰化多肽受体   |
| form-cue invariance                      | 形式线索不变性   |
| fornix                                   | 穹窿        |
| forward dynamic                          | 前向动力学     |
| forward model                            | 前向模型      |
| foundling home                           | 弃儿养育院     |
| Fourth ventricle                         | 第四脑室      |
| fractalkine                              | 分形趋化因子    |

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| fragile X mental retardation protein (FMRP)                     | 脆性 X 智力迟钝蛋白     |
| fragile X syndrome  | 脆性 X 综合症        |
| frameshift mutation   | 框移突变            |
| Francis Crick   | 弗朗西斯·克里克        |
| Francis Galton  | 弗朗西斯·高尔顿        |
| Francisco Tello   | 弗朗西斯科·特略        |
| Franz Joseph Gall (Gall)  | 弗朗兹·约瑟夫·加尔      |
| Franz Kalman  | 弗兰茨·卡尔曼         |
| Free nerve endings  | 游离神经末梢          |
| freezing response   | 响应僵滞            |
| Frederic Bartlett   | 弗雷德里克·巴特莱特      |
| Frederick Toates  | 弗雷德里克·托茨        |
| frequency-modulated (FM)  | 调频              |
| Frey  | 弗雷              |
| Frontal Eye Field (FEF)   | 额叶视区            |
| frontal operculum   | 额岛盖             |
| frontoinsular cortex (FI)                                       | 前岛叶皮层           |
| frontopolar cortex (FPC)  | 额极皮层            |
| frontotemporal dementia   | 额颞痴呆            |
| frontotemporal dementia with Parkinson disease type 17 (FTPD17) | 额颞叶痴呆伴帕金森病 17 型 |
| fruitless (Fru)   | 无效基因            |
| Fukuyama congenital muscular dystrophy                          | 福山型先天性肌营养不良     |
| functional connectivity   | 功能连接            |
| functional electrical stimulation (FES)                         | 功能性电刺激          |
| functional magnetic resonance imaging (fMRI)                    | 功能性核磁共振成像       |
| fusiform face area (FFA)  | 梭状回面孔区          |
| fusiform gyrus (FG)   | 梭状回             |
| fusimotor system  | 肌梭运动系统          |
| future receptive field (FRF)                                    | 未来感受野           |
| Fuxe  | 富克塞             |
| Fyodor Dostoyevsky  | 费奥多尔·陀思妥耶夫斯基    |

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| F. A. Gibbs  | 吉布斯             |
| F. Barbara Hughes  | 芭芭拉·休斯          |
| F-Actin  | 纤维状肌动蛋白         |
| G protein-coupled receptors                                      | G-蛋白偶联受体        |
| G protein-gated inward-rectifier K <sup>+</sup> (GIRK)           | G蛋白门控的内向整流钾     |
| GABA transporter (GAT)   | γ-氨基丁酸转运蛋白      |
| GABAergic  | γ-氨基丁酸能         |
| gag reflex   | 呕吐反射            |
| gain field   | 增益场             |
| galanin (GAL)  | 甘丙肽             |
| Galen  | 盖伦              |
| gap junction   | 细胞间隙连接          |
| gap-junction channel   | 间隙连接通道          |
| Garrett Alexander  | 加勒特·亚历山大        |
| gastrocnemius (GAS)  | 腓肠肌             |
| gastrointestinal reflexes  | 肠胃反射            |
| Gaucher disease  | 戈谢病             |
| gaze-evoked nystagmus  | 凝视诱发性眼震         |
| gene profile   | 基因谱             |
| general knowledge  | 常识              |
| Generalized anxiety disorder (GAD)                               | 广泛性焦虑障碍         |
| generalized epilepsy with febrile seizures plus (GEFS+ syndrome) | 全面性癫痫伴热性惊厥附加综合症 |
| genetic markers of calcium transients (GCaMPs)                   | 钙瞬变的遗传标记        |
| genetically encoded voltage indicators (GEVIs)                   | 基因编码的电压指示剂      |
| genioglossus   | 颏舌肌             |
| Genital ridge  | 生殖嵴             |
| genome   | 基因组             |
| genome-wide association studies (GWAS)                           | 全基因组关联研究        |
| genotypephenotype  | 基因型-表现型         |
| Geoffrey Harris  | 杰弗里·哈里斯         |

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|--|-------------------|
| Georg Wilhelm Friedrich Hegel                      | 格奥尔格·威廉·弗里德里希·黑格尔 |
| Georg von Békésy                                   | 盖欧尔格·冯·贝凯希        |
| George Berkeley                                    | 乔治·伯克利            |
| George Eisenman                                    | 乔治·艾森曼            |
| George Ojemann                                     | 乔治·奥杰曼            |
| George Oliver                                      | 乔治·奥利弗            |
| George Widener                                     | 乔治·怀德纳            |
| gephyrin   | 桥蛋白               |
| geranyl  | 香叶基               |
| geranylgeranyl (gg)                                | 香叶基香叶基            |
| Ghrelin  | 生长激素释放肽           |
| Gigaxonin  | 巨轴索神经蛋白           |
| Gill-withdrawal reflex                             | 缩鳃反射              |
| Giulio Tononi                                      | 朱利奥·托诺尼           |
| Giuseppe Tartini                                   | 朱塞佩·塔蒂尼           |
| Giuseppe Verdi                                     | 朱塞佩·威尔第           |
| glabrous skin                                      | 光滑皮肤              |
| glass electrode                                    | 玻璃电极              |
| glial cell (G)                                     | 胶质细胞              |
| glial cell line-derived neurotrophic factor (GDNF) | 胶质细胞源性神经营养因子      |
| Glial scar   | 胶质瘢痕              |
| glial-fibrillary acidic protein (GFAP)             | 胶质纤维酸性蛋白          |
| global aphasia                                     | 全面性失语症            |
| globose nucleus                                    | 球状核               |
| globus pallidus (GP)                               | 苍白球               |
| glomeruli  | 嗅小球               |
| Glossopharyngeal nerve                             | 舌咽神经              |
| Glucagonlike peptide-1 (GLP-1)                     | 胰高糖素样肽-1          |
| glucocerebrosidase-1 (GBA1)                        | 葡糖脑苷脂酶-1          |
| glucocorticoid receptor (GR)                       | 糖皮质激素受体           |
| glutamate decarboxylase (GAD)                      | 谷氨酸脱羧酶            |
| glutamate excitotoxicity                           | 谷氨酸兴奋性中毒          |

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|--|-------------------|
| Glutamate Receptor Interacting Protein (GRIP)    | 谷氨酸受体相互作用蛋白       |
| glutamate-sensing fluorescent reporter (GluSnFR) | 谷氨酸盐感应荧光受体        |
| glutamatergic neurons                            | 谷氨酸能神经元           |
| glutamine (Gln)                                  | 谷氨酰胺              |
| glutamine synthetase (GS)                        | 谷氨酰胺合成酶           |
| glutamate transporter (GLT)                      | 谷氨酸转运体            |
| Glycine (Gly)                                    | 甘氨酸               |
| glycine transporter (GLYT2)                      | 甘氨酸转运蛋白           |
| glycican   | 一种蛋白聚糖            |
| glycogen synthase kinase type 3 $\beta$          | 糖原合成酶激酶-3 $\beta$ |
| Glycoprotein 130 (GP130)                         | 糖蛋白 130           |
| goat-like  | 膻味                |
| Goldman equation                                 | 戈德曼方程             |
| Golgi apparatus                                  | 高尔基体              |
| Golgi cell                                       | 高尔基细胞             |
| Golgi cisternae                                  | 高尔基间隙             |
| Golgi tendon organ                               | 高尔基腱器             |
| Gonadotropin-releasing hormone (GnRH)            | 促性腺激素释放激素         |
| Gordon Holmes                                    | 戈登·霍姆斯            |
| Gören Westling                                   | 格伦·韦斯特林           |
| Gracile fascicle                                 | 薄束                |
| granule cell                                     | 颗粒细胞              |
| granular layer                                   | 颗粒层               |
| Graves disease                                   | 格氏眼病              |
| gravitoinertial acceleration (GIA)               | 重力-惯性加速度          |
| green fluorescent protein (GFP)                  | 绿色荧光蛋白            |
| Gregory Hickok                                   | 格雷戈里·希科克          |
| Gregory McCarthy                                 | 格雷戈里·麦卡锡          |
| Grendel  | 格伦德尔              |
| grid cell  | 网格细胞              |
| grid field                                       | 网格场               |
| growth associated protein 43 (GAP-43)            | 神经生长相关蛋白-43       |

|  |             |
|--|-------------|
| Growth hormone release-inhibiting hormone (GIH, GHRIH)       | 生长抑素        |
| growth hormone-releasing hormone (GHRH)                      | 生长激素-释放激素   |
| growth hormone (GH)  | 生长激素        |
| growth hormone-inhibiting hormone (GIH)                      | 生长激素抑制激素    |
| GTP-binding protein (G protein, GTP, Guanosine triphosphate) | 三磷酸鸟苷结合蛋白   |
| Guanine (G)  | 鸟嘌呤         |
| guanosine diphosphate (GDP)                                  | 二磷酸鸟苷       |
| guanylate kinase (GK)  | 鸟苷酸激酶       |
| guanylate kinase associated protein (GK-associated protein)  | 鸟苷酸激酶相关蛋白   |
| guanylate cyclase (GC)                                       | 鸟苷酸环化酶      |
| Guillain-Barré syndrome                                      | 古兰-巴雷综合症    |
| Guntram Kommerell  | 冈特拉姆·科默尔    |
| Gustatory afferent nerve                                     | 味觉传入神经      |
| gustatory receptor   | 味觉受体        |
| Gustav Fechner   | 古斯塔夫·费希纳    |
| Gustav Fritsch   | 古斯塔夫·弗里奇    |
| glutamate/aspartate transporter (GLAST)                      | 谷氨酸/天冬氨酸转运体 |
| gyromagnetic ratio   | 磁旋比         |
| G-actin  | 球状肌动蛋白      |
| Hadyn Ellis  | 海丁·埃利斯      |
| hair bundle  | 发状纤维束       |
| hair cell  | 毛细胞         |
| hair follicle  | 毛囊          |
| hairy skin   | 毛发皮肤        |
| Håkan Olausson   | 哈肯·奥劳森      |
| Haldan Keffer Hartline                                       | 霍尔登·凯弗·哈特兰  |
| halfway house  | 重返社会训练所     |
| halorhodopsin  | 嗜盐菌视紫红质     |
| hamstring (HAM)  | 腿筋          |
| Hans Asperger  | 汉斯·阿斯伯格     |
| Hans Berger  | 汉斯·伯杰       |
| Hans Kuypers   | 汉斯·凯珀斯      |

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|----------------------------|------------------------|
| Hans Spemann               | 汉斯·斯佩曼                 |
| Hans-Lukas Teuber          | 汉斯-卢卡斯·特伯              |
| Haplorhini                 | 灵长目亚目                  |
| haplotype                  | 单倍型                    |
| Harlows                    | 哈洛斯                    |
| Harold Wilson              | 哈罗德·威尔逊                |
| Harry                      | 哈里                     |
| Head direction cell        | 头部朝向细胞                 |
| heart rate variability     | 心率变异性                  |
| Heat shock protein 27      | 热休克蛋白 27               |
| Hebbian plasticity         | 赫布可塑性                  |
| hedgehog                   | 刺猬蛋白                   |
| Heiner Deubel              | 海纳·多伊贝尔                |
| Heinrich Klüver            | 海因里希·克鲁瓦               |
| Helen Neville              | 海伦·内维尔                 |
| helicotrema                | 蜗孔                     |
| Henrik Jähnsen             | 亨里克·扬森                 |
| Henry Dale                 | 亨利·戴尔                  |
| Henry Head                 | 亨利·海德                  |
| Henry Laborit              | 亨利·拉博里                 |
| Henry Molaison (HM, H.M.)  | 亨利·莫莱森                 |
| Hensen's cells             | 亨森细胞                   |
| Herbert Jasper             | 赫伯特·杰士伯                |
| Hering-Breuer reflex       | 肺牵张反射 (黑-伯反射, 黑林-伯鲁反射) |
| Heritability               | 遗传可能性                  |
| Hermann Helmholtz          | 赫尔曼·亥姆霍兹               |
| Hermann von Helmholtz      | 赫尔曼·冯·亥姆霍兹             |
| herpes simplex virus (HSV) | 单纯疱疹病毒                 |
| heterochromatin            | 异染色质                   |
| heterosynaptic plasticity  | 异突触可塑性                 |
| hevin                      | 高内皮静脉蛋白                |
| high vocal center (HVC)    | 高级发声中枢                 |
| highfunctioning autism     | 高功能孤独症                 |

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| high-threshold mechanoreceptor (HTMR)                    | 高阈值机械感受器     |
| high-threshold or high-voltage activated (HVA)           | 高阈值或高压激活     |
| Hilde Mangold  | 希尔德·曼戈尔德     |
| hip strategy   | 髋关节策略        |
| hippocampal formation                                    | 海马体结构        |
| Hippocrates  | 希波克拉底        |
| hnRNP (heterogeneous nuclear ribonucleoprotein)          | 异构核糖核蛋白颗粒    |
| Hoffmann-reflex (H-reflex)                               | 霍夫曼反射 (H 反射) |
| Home plate   | 本垒板          |
| homeodomain protein                                      | 同源异型结构域蛋白    |
| homeostasis  | 内稳态          |
| homeostatic plasticity                                   | 稳态可塑性        |
| homosynaptic plasticity                                  | 同突触可塑性       |
| Homunculi  | 小矮人          |
| Horace Barlow  | 霍勒斯·巴洛       |
| horizontal canal   | 水平耳道         |
| horizontal component of the ground reaction force (GRFh) | 地面反作用力的水平分量  |
| horizontal limb of the diagonal band (DBh)               | 斜角带水平支       |
| horizontal plane   | 水平面          |
| hormonal action  | 荷尔蒙作用        |
| Horner syndrome  | 霍纳综合症        |
| hospitalism  | 医院病          |
| how pathway  | 方法通路         |
| Howard Curtis  | 霍华德·柯蒂斯      |
| Howard Eichenbaum  | 霍华德·艾肯鲍姆     |
| Hox genes  | 同源异型基因       |
| Hox protein (HOX protein)                                | 同源异型蛋白       |
| Hubbard  | 哈伯德          |
| Huda Zoghbi  | 胡达·佐格比       |
| huntingtin   | 亨廷顿蛋白        |
| Huntington   | 亨廷顿病         |

|   |                  |
|---|------------------|
| Huntington-like 2   | 类亨廷顿病 2 型        |
| hydranencephaly   | 积水性无脑畸形          |
| hydroperoxyeicosatetraenoic acid (HPETE)                          | 羟过氧化二十碳四烯酸       |
| hypercolumn   | 皮层柱              |
| hyperpolarization-activated cyclic nucleotide-gated channel (HCN) | 超极化激活环核苷酸门控阳离子通道 |
| hypocretin  | 下视丘分泌素           |
| hypoglossal nerve   | 舌下神经             |
| hypoglossal nucleus   | 舌下神经核            |
| Hypoglossal nucleus (nXIIts)                                      | 舌下神经核            |
| Hypokalemic periodic paralysis (HypoPP)                           | 低钾性周期性麻痹         |
| hypometric saccades   | 辨距不足的扫视          |
| hypothalamic–pituitary–adrenal (HPA)                              | 下丘脑-垂体-肾上腺       |
| hypothalamus (HT)   | 下丘脑              |
| hysteria  | 癔症               |
| hysterical amnesia  | 癔症性遗忘            |
| H-wave  | 霍夫曼波             |
| Ilya Repin  | 伊利亚·列宾           |
| Immanuel Kant   | 伊曼努尔·康德          |
| immunoglobulin (IgE)  | 免疫球蛋白            |
| Immunoglobulin superfamily  | 免疫球蛋白超家族         |
| implicit memory   | 内隐记忆             |
| impulses per second (ips)   | 每秒脉冲数            |
| In vitro  | 体外               |
| Inclusion body myositis   | 包涵体肌炎            |
| Index finger  | 食指               |
| induced pluripotent stem (iPS)                                    | 诱导的多能性干细胞        |
| inductive factor  | 诱导因子             |
| indel   | 插入缺失突变           |
| induced pluripotent stem cells (iPSCs)                            | 诱导性多功能干细胞        |
| inducer   | 诱导剂              |
| inferior cerebellar peduncle                                      | 小脑下脚             |

|   |              |
|---|--------------|
| inferior colliculus (IC)                                | 下丘           |
| inferior frontal gyrus (IFG)                            | 额下回          |
| inferior oblique  | 下斜肌          |
| inferior olive  | 下橄榄核         |
| inferior posterior regions of prefrontal cortex (IPPFC) | 后下部前额叶皮层     |
| inferior rectus   | 下直肌          |
| inferior rectus   | 下直肌          |
| inferotemporal cortex                                   | 下颞皮层         |
| information transfer rate (ITR)                         | 信息传递率        |
| infralimbic cortex                                      | 下边缘皮层        |
| inhibitory interneuron                                  | 抑制性中间神经元     |
| inhibitory postsynaptic potential (IPSP)                | 抑制性突触后电位     |
| initial segment   | 起始段          |
| inner fiber layer (IFL)                                 | 内纤维层         |
| inner plexiform layer                                   | 内网层          |
| inner subventricular zone (ISVZ)                        | 室下内侧区        |
| inositol 1,4,5-trisphosphate ( $IP_3$ )                 | 肌醇 1,4,5-三磷酸 |
| insertional plaque                                      | 附着斑          |
| insula (Ins)  | 脑岛           |
| insulin-degrading enzyme (IDE)                          | 胰岛素降解酶       |
| insulin-like growth factor-1 (IGF-1)                    | 胰岛素样生长因子 1   |
| integrator circuits                                     | 整合器回路        |
| Integrin  | 整联蛋白         |
| intensity (I)   | 强度           |
| interleukin-1 (IL-1)                                    | 白细胞介素-1      |
| intermediate zone (IZ)                                  | 中间区          |
| Internal auditory canal                                 | 内耳道          |
| Internal segment  | 内侧部          |
| Internal segment  | 内侧部          |
| internuclear ophthalmoplegia                            | 核间性眼肌麻痹      |
| interposed nuclei (IP)                                  | 间位核          |
| interpositus nucleus                                    | 间位核          |
| interstimulus interval (ISI)                            | 刺激间距         |

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|--|---------|
| Interstitial fluid (ISF)                                   | 间质液     |
| interstitial nucleus of the medial longitudinal fasciculus | 内侧纵束间质核 |
| interstitial nucleus of the anterior hypothalamus (INAH)   | 下丘脑前间质核 |
| internal globus pallidus (GPi, Gpi)                        | 苍白球内侧核  |
| Internal medullary lamina                                  | 内髓板     |
| internal segment of the globus pallidus (GPi)              | 苍白球内侧   |
| interposed nucleus   | 间位核     |
| intracortical microstimulation (ICMS)                      | 皮层内微刺激  |
| intorsion  | 内旋      |
| Intracortical electrodes                                   | 皮层内电极   |
| Inferior frontal gyrus                                     | 额下回     |
| infundibular recess (IFR)                                  | 漏斗隐窝    |
| inosine monophosphate (IMP)                                | 肌苷一磷酸   |
| instrumental conditioning                                  | 工具性条件反射 |
| interaural time difference (ITD)                           | 双耳时间差   |
| internal mouthparts  | 口腔内部器官  |
| intracranial electroencephalography (iEEG)                 | 颅内脑电图   |
| intralaminar nuclei  | 髓板内核团   |
| intralaminar thalamic nuclei (ILT)                         | 丘脑髓板内核  |
| intraparietal sulcus (IPS)                                 | 顶内沟     |
| Intelligence Quotient (IQ)                                 | 智商      |
| intention tremor   | 意向性震颤   |
| intercalated nuclei  | 嵌入核     |
| interstitial nucleus of Cajal (iC)                         | 间位核     |
| Intrinsic Reinforcement                                    | 内部强化    |
| inverse model  | 反向模型    |
| inverse dynamic  | 反向动力学   |
| Irwin Feinberg   | 欧文·范伯格  |
| Irving Gottesman   | 欧文·戈特斯曼 |
| Isidor Rabi  | 伊西多·拉比  |
| isoamyl acetate  | 乙酸异戊酯   |
| Isolectin B4 (IB4)   | 植物凝集素   |

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| Isthmic Organizer  | 组织中心              |
| Ivan Pavlov  | 伊万·巴甫洛夫           |
| Jack MacMahan  | 杰克·马克汉            |
| Jackson Grandour   | 杰克逊·格兰登           |
| Jacksonian march   | 杰克逊式行军            |
| Jacob Schleiden  | 雅各布·施莱登           |
| Jacques Duchateau  | 雅克·杜查托            |
| JamB retinal ganglion cell (J-RGC)                                       | JamB 视网膜神经节细胞     |
| James Albus  | 詹姆斯·阿尔布斯          |
| James Gibson   | 詹姆斯·吉布森           |
| James J. DiCarlo   | 詹姆斯·迪卡罗           |
| James J. Gibson  | 詹姆斯·吉布森           |
| James Olds   | 詹姆斯·奥尔兹           |
| James Papez  | 詹姆斯·帕佩兹           |
| James Rothman  | 詹姆斯·罗斯曼           |
| Janus kinase-signal transducer and activator of transcription (JAK/STAT) | 两面神激酶-信号转导和转录激活因子 |
| Jean Pierre Changeux   | 让·皮埃尔·尚热          |
| Jeffrey Friedman   | 杰弗里·弗里德曼          |
| Jeffrey Hall   | 杰弗里·霍尔            |
| Jeffrey Noebels  | 杰弗里·诺贝尔斯          |
| Jenny Saffran  | 珍妮·扎弗兰            |
| Jens Brauer  | 延斯·布劳尔            |
| Jerzy Konorski   | 杰泽·科诺尔斯基          |
| jimpy mouse  | 神经髓鞘形成不全鼠         |
| Joel Richter   | 约尔·里希特            |
| Johan Wessberg   | 约翰·威斯伯格           |
| John Cade  | 约翰·凯德             |
| John Carew Eccles (John C. Eccles)                                       | 约翰·卡鲁·埃克尔斯        |
| John Dostrovsky  | 约翰·多斯特罗夫斯基        |
| John Langley   | 约翰·兰利             |
| John Locke   | 约翰·洛克             |
| John O' Keefe  | 约翰·奥基夫            |
| Jorgensen  | 约根森               |

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|--|---------------------------|
| Joseph Takahashi                                   | 约瑟夫·高桥                    |
| jugular foramen                                    | 颈静脉孔                      |
| Junctional fold                                    | 接头皱褶                      |
| Johannes Müller                                    | 约翰内斯·米勒                   |
| John B. Watson                                     | 约翰·布鲁德斯·华生                |
| John Eccles  | 约翰·埃克尔斯                   |
| John Gardner                                       | 约翰·加德纳                    |
| John Heuser  | 约翰·霍伊泽尔                   |
| John Hughlings Jackson                             | 约翰·休林斯·杰克逊                |
| John Lisman  | 约翰·利斯曼                    |
| John Marshall                                      | 约翰·马歇尔                    |
| John N. Langley                                    | 约翰·兰里                     |
| John Stuart Mill                                   | 约翰·斯图尔特·穆勒                |
| John Swets   | 约翰·斯维兹                    |
| Jonathan Wolpaw                                    | 乔纳森·沃尔帕乌                  |
| Josef Rauschecker                                  | 约瑟夫·罗斯柴可                  |
| Joseph Altman                                      | 约瑟夫·伯根                    |
| Joseph Bogen                                       | 约瑟夫·奥特曼                   |
| Juhani Hyvärinen                                   | 朱汉尼·海瓦里宁                  |
| Jules Dejerine                                     | 朱尔斯·代热林                   |
| Julius Axelrod                                     | 朱利叶斯·阿克塞尔罗德               |
| just noticeable difference (JND)                   | 最小可觉差                     |
| Juxtaparanode                                      | 近结                        |
| J. Anthony Movshon                                 | 安东尼·穆松                    |
| J. N. Langley                                      | 兰列                        |
| K channel of streptomyces A ( <b>KcsA</b> )        | 链霉菌 A 的 K <sup>+</sup> 通道 |
| K complex  | K-复合波                     |
| Kalman filter decoding<br>movement velocity (V-KF) | 解码运动速度卡尔曼滤波器              |
| Kainate  | 红藻氨酸                      |
| Karim Nader  | 卡里姆·奈德                    |
| Karl Lashley                                       | 卡尔·拉什利                    |
| Karl-Erik Hagbarth                                 | 卡尔·艾瑞克·哈格巴斯               |
| Kathy Cullen                                       | 凯西·库伦                     |

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| Kausik Si                                | 考斯克·斯伊            |
| KCNJ                                     | 钾内向整流通道亚家族 J 成员   |
| Kelsey Martin                            | 凯尔西·马丁            |
| Ken Johnson                              | 肯·约翰逊             |
| Kenneth Cole                             | 肯尼思·科尔            |
| Kenneth Craik                            | 肯尼思·克雷克           |
| Kent Berridge                            | 肯特·贝里奇            |
| Kenyon cell                              | 凯尼恩细胞             |
| kiloDalton (kD)                          | 千道尔顿              |
| Kinesin motor                            | 驱动蛋白              |
| kinocilium                               | 动纤毛               |
| kisspeptin                               | 亲吻肽               |
| kiss-and-run                             | 亲完就跑              |
| Klein                                    | 克莱因               |
| Klopff                                   | 克洛普夫              |
| Klüver-Bucy syndrome                     | 克鲁瓦·布伊综合症         |
| knee jerk                                | 膝跳                |
| Koniocellular                            | 粒状                |
| Korbinian Brodmann                       | 科比尼安·布罗德曼         |
| Kringle domain                           | 环状结构域             |
| Kurt Goldstein                           | 科特·戈德斯坦           |
| Kurt Koffka                              | 库尔特·考夫卡           |
| Lambert-Eaton syndrome                   | 兰伯特-伊顿综合症（肌无力综合症） |
| Lambert-Eaton myasthenic syndrome (LEMS) | 兰伯特-伊顿肌无力综合症      |
| Lamin                                    | 核纤层蛋白             |
| lamina                                   | 薄层                |
| Laminin                                  | 层连蛋白              |
| lamotrigine                              | 拉莫三嗪              |
| Larmor equation                          | 拉莫尔方程             |
| lamellipodia                             | 板状伪足              |
| Lanterman                                | 兰特曼               |

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| large conductance voltage-and calcium-activated K <sup>+</sup> (BK channels) | 大电导钙激活钾离子通道       |
| large diameter (Ia)  | 大直径               |
| Larmor frequency   | 拉莫尔频率             |
| Larry Squire   | 拉里·斯奎尔            |
| Larry Weiskrantz   | 拉里·维斯克兰茨          |
| Larsell  | 拉塞尔               |
| lateral gastrocnemius (LG)   | 外侧胫骨后肌            |
| lateral geniculate nucleus (LGN)   | 外侧膝状体核            |
| lateral hypothalamic area (LHA)  | 下丘脑外侧区            |
| lateral hypothalamus (LH)  | 外侧下丘脑             |
| Lateral Inhibition   | 侧抑制               |
| lateral intraparietal area (LIP)   | 侧顶叶               |
| lateral intraparietal area, ventral portion (LIPv)                           | 侧顶叶腹侧部            |
| lateral habenula   | 外侧缰核              |
| lateral hypothalamus (LH)  | 外侧下丘脑             |
| lateral magnocellular nucleus of the anterior neostriatum (LMAN)             | 新纹状体前部<br>大细胞核外侧部 |
| lateral motor columns (LMC)  | 外侧运动柱             |
| lateral parabrachial nucleus   | 臂旁外侧核             |
| lateral parietal   | 顶叶外侧              |
| lateral rectus   | 外直肌               |
| Lateral sinus  | 横窦                |
| lateral septum (LS)  | 外侧隔核              |
| Lateral Superior Olivary(LSO)  | 外侧上橄榄             |
| lateral vestibular nucleus (LVN)   | 前庭外侧核             |
| lateral vestibulospinal tracts (LVST)  | 外前庭脊髓束            |
| lateral view   | 侧视图               |
| Laterodorsal tegmental nucleus   | 背外侧被盖核            |
| laterodorsal tegmental nucleus (LDT)   | 背外侧被盖核            |
| rostromedial tegmentum (RTM)   | 嘴内侧被盖区            |
| Laura-Anne Pettito   | 劳拉·安妮·佩蒂托特        |

|   |            |
|---|------------|
| Law of Effect                             | 效果律        |
| Lawrence Weiskrantz                       | 劳伦斯·魏斯克朗茨  |
| le milieu interior (internal environment) | 内环境        |
| leakage current                           | 泄漏电流       |
| Leborgne                                  | 勒博涅        |
| left CPG (lF)                             | 左中枢模式发生器   |
| left flexor motor neurons (lFmn)          | 左屈肌运动神经元   |
| left forelimb (lFL, LFL)                  | 左前肢        |
| left hemisphere (LH)                      | 左半球        |
| left hindlimb (lHL, LHL)                  | 左后肢        |
| Levi-Montalcini                           | 列维-蒙塔尔奇尼   |
| Leo Kanner                                | 利奥·肯纳      |
| Leslie Ungerleider                        | 莱斯利·安格莱德   |
| Leucine-enkephalin (Leu-enkephalin)       | 亮氨酸脑啡肽     |
| levator                                   | 眼提肌        |
| Lewy body                                 | 路易小体       |
| Lewy body dementia                        | 路易体痴呆      |
| lick and groom (LG)                       | 舔舐和梳理      |
| Liddell                                   | 里德尔        |
| lidocaine                                 | 利多卡因       |
| Ligand gating                             | 配体门控       |
| Ligand-gated channel                      | 配体门控通道     |
| light period (LP)                         | 光照周期       |
| likely gene disrupting (LGD)              | 可能的基因破坏    |
| likelihood ratio (LR)                     | 似然比        |
| limb-girdle muscular dystrophy (LGMD)     | 肢带型肌营养不良   |
| Limiting ridge                            | 限制脊        |
| Limulus                                   | 鲎鱼         |
| lipoprotein-related protein 4 (LPR4)      | 脂蛋白相关蛋白 4  |
| Lissauer's tract                          | 背外侧束, 利绍尔束 |
| Lloyd Jeffress                            | 劳埃德·杰夫里斯   |
| local field potential (LFP)               | 局部场电位      |

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|---|--------------|
| local neuron  | 局部神经元        |
| locus   | 基因座          |
| locus ceruleus (LC)                                       | 蓝斑           |
| Logothetis  | 洛戈塞蒂斯        |
| log-likelihood ratio (logLR)                              | 对数似然比        |
| longitudinal study  | 追踪研究         |
| long noncoding RNA (lncRNA)                               | 长链非编码核糖核酸    |
| long-range projection neuron                              | 长程投射神经元      |
| long-term depression (LTD)                                | 长时程抑制        |
| Long-term facilitation                                    | 长时程易化        |
| Long-term memory  | 长时记忆         |
| long-term potentiation (LTP)                              | 长时程增强        |
| Lorne Mendell   | 洛恩·孟德尔       |
| Louis Kunkel  | 路易斯·孔克尔      |
| Louis Ptáček  | 路易斯·普塔切克     |
| low voltage activated (LVA)                               | 低电压激活        |
| low-density lipoprotein receptor-related protein 4 (LRP4) | 低密度脂蛋白受体相关蛋白 |
| low-threshold mechanoreceptors (LTMR)                     | 低阈值机械感受器     |
| low-voltage activated (LVA)                               | 低压激活         |
| Louise Goupil   | 路易丝·古皮尔      |
| Lynn Nadel  | 林恩·纳德尔       |
| lysergic acid diethylamide (LSD)                          | 麦角酸二乙酰胺      |
| Lugaro cell   | 卢加洛细胞        |
| Luigi Galvani   | 路易吉·加尔瓦尼     |
| luteinizing hormone-releasing hormone (LHRH)              | 黄体生成素-释放激素   |
| l-dihydroxyphenylalanine (l-DOPA)                         | l-多巴         |
| L.L. Thurstone  | 瑟斯顿          |
| Machado-Joseph disease                                    | 马查多-约瑟夫病     |
| MacLean   | 麦克莱恩         |
| Macrophage infiltration                                   | 巨噬细胞浸润       |
| mad cow disease   | 疯牛病          |
| Magnetoencephalography (MEG)                              | 脑磁图          |

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| magnifying glasses                               | 放大镜                 |
| magnocellular ganglion cell                      | 大神经节细胞              |
| Mahowald   | 马霍瓦尔德               |
| malignant hyperthermia                           | 恶性高热                |
| main olfactory bulb (MOB)                        | 主嗅球                 |
| main olfactory epithelium (MOE)                  | 主嗅上皮                |
| marginal zone (MZ)                               | 边缘区                 |
| major depression (major depressive disorder)     | 重度抑郁症               |
| major histocompatibility (MHC)                   | 主要组织相容性             |
| mammalian target of rapamycin (mTOR)             | 哺乳动物雷帕霉素靶蛋白         |
| mammalian target of rapamycin complex 1 (mTORC1) | 哺乳动物雷帕霉素靶蛋白复合体 1    |
| mammalian uncoordinated-13 (Munc13)              | 哺乳动物非协调蛋白 13        |
| mammillothalamic tract (MTT)                     | 乳头丘脑束               |
| mandibular division ( $V_3$ )                    | 下颌分支                |
| mantle shelf                                     | 外套膜                 |
| manual tracking                                  | 手动跟踪                |
| Marathon des Sables                              | 撒哈拉沙漠马拉松赛           |
| Marc Jeannerod                                   | 马克·珍妮罗德             |
| Marc Jeannerod                                   | 马库斯·赖希勒             |
| Margaret Harlow                                  | 玛格丽特·哈洛             |
| Mark Bear  | 马克·贝尔               |
| Mark Wightman                                    | 马克·怀特曼              |
| Marla Sokolowski                                 | 玛尔拉·索科洛夫斯基          |
| Mars   | 马尔斯                 |
| Martinotti cell                                  | 马氏细胞                |
| Masao Ito  | 马佐·伊托               |
| masking effect                                   | 遮蔽效应                |
| Mast cell  | 肥大细胞                |
| Mas-related G protein-coupled receptor (Mrgpr)   | Mas 相关三磷酸鸟苷结合蛋白偶联受体 |
| Maurice Merleau-Ponty                            | 莫里斯·梅洛-庞蒂           |
| Maurice Smith                                    | 莫里斯·史密斯             |

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| Maurizio Corbetta  | 毛里齐奥·科尔贝塔        |
| Mauthner cell  | 毛特讷氏细胞           |
| Max Wertheimer   | 马克斯·韦特海默         |
| maxillary division ( $V_2$ )   | 上颌分支             |
| maximal voluntary contraction (MVC)  | 最大自主收缩           |
| maximum pulling force (MPF)  | 最大拉力             |
| May-Britt Moser  | 梅·布里特·莫泽         |
| McLeod syndrome  | 麦克劳德综合症          |
| measles-mumps-rubella (MMR)  | 麻疹-腮腺炎-风疹        |
| mechanical nociceptor  | 机械性伤害感受器         |
| mechanoelectrical transduction   | 机电转导             |
| No mechanoreceptor potential C (NOMPC)   | 无机械感受器电位 C       |
| MECP2 duplication syndrome (MDS)   | 甲基-CpG 结合蛋白重复综合症 |
| medial amygdala (MeA)  | 内侧杏仁核            |
| medial division of the posteromedial<br>bed nucleus of the<br>stria terminalis (BNSTmpm) | 终纹床核后侧的内侧分裂      |
| Medial Geniculate Body (MGB)   | 内侧膝状体            |
| medial frontal cortex (mF10)   | 内侧前额叶皮层          |
| medial ganglionic eminence   | 内侧神经节隆起          |
| medial geniculate nucleus (MGN)  | 内侧膝状体核           |
| medial group   | 内侧核群             |
| medial intraparietal area (MIP)  | 内顶叶内区            |
| medial lateral (ML)  | 中外侧              |
| medial longitudinal fasciculus   | 内侧纵束             |
| medial nucleus of the<br>dorsolateral thalamus (DLM)                                     | 丘脑背外侧内侧核         |
| Medial Nucleus of<br>the Trapezoid Body (MNTB)   | 斜方体内侧核           |
| medial prefrontal cortex   | 内侧前额叶皮层          |
| medial preoptic nucleus  | 视前内侧核            |
| medial rectus  | 内直肌              |
| medial reticular formation (MRF)   | 内侧网状结构           |
| Medial Superior Olive(MSO)   | 内侧上橄榄            |

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| medial superior temporal area (MST)     | 上颞内侧区     |
| median nerve                            | 正中神经      |
| median eminence                         | 正中隆起      |
| medial septum (MS)                      | 内侧隔核      |
| medial superior temporal (MST)          | 内侧颞叶上部    |
| medial temporal (MT)                    | 内侧颞叶      |
| medial vestibulospinal tracts (MVST)    | 内前庭脊髓束    |
| median preoptic nucleus (MNPO, MnPO)    | 正中视前核     |
| mediodorsal nucleus (MD)                | 背内侧核      |
| medium spiny neuron                     | 中型多棘神经元   |
| medulla nuclei                          | 延髓网状结构    |
| medullary pyramid                       | 延髓锥体      |
| medullary reticular formation           | 延髓网状结构    |
| Meissner                                | 梅斯诺小体     |
| Mel Goodale                             | 梅尔·古德尔    |
| melaninconcentrating hormone (MCH)      | 黑色素浓缩素    |
| melanocortin-4 receptors (MC4R)         | 黑素皮质素受体 4 |
| melanopsin                              | 黑视蛋白      |
| memantine                               | 美金刚       |
| memory replay                           | 记忆回放      |
| mental disorder                         | 精神障碍      |
| Merck Index                             | 默克索引      |
| Merkel cell                             | 梅克尔细胞     |
| Merzenich                               | 梅策尼希      |
| mesencephalic locomotor region (MLR)    | 中脑移动区     |
| mesencephalic reticular formation       | 中脑网状结构    |
| mesenchymal cell                        | 间充质细胞     |
| mesopontine groups                      | 中脑脑桥组     |
| messenger Ribonucleic Acid (mRNA)       | 信使核糖核酸    |
| Met                                     | 尿蛋氨酸      |
| meta-analyses                           | 荟萃分析      |
| metabotropic glutamate receptor (mGluR) | 代谢型谷氨酸受体  |
| Metazoan                                | 后生动物      |

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| Methionine-enkephalin (Met-enkephalin)              | 甲硫氨酸脑啡肽               |
| methyl-CpG-binding protein-2 (MECP2)                | 甲基-CpG 结合蛋白           |
| Meyer's loop  | 梅耶环束                  |
| Michael Gazzaniga                                   | 迈克尔·加扎尼加              |
| Michael Mauk  | 迈克尔·莫克                |
| Michael Meaney                                      | 迈克尔·米尼                |
| Michael Rosbash                                     | 迈克尔·罗斯巴什              |
| Michael Shadlen                                     | 迈克尔·沙德兰               |
| Michael Young                                       | 迈克尔·杨                 |
| microRNA (miRNA)                                    | 微小核糖核酸                |
| midbrain-hindbrain boundary (MHB)                   | 中脑和后脑边界               |
| middle cerebellar peduncle (MCP)                    | 小脑中脚                  |
| microtubule-associated proteins (MAPs)              | 微管相关蛋白                |
| midsagittal section                                 | 正中矢状断面                |
| membrane time constant                              | 膜时间常数                 |
| Michaelis-Menten equation                           | 米氏方程                  |
| microtubule-associated protein tau                  | 微管相关蛋白, tau 蛋白        |
| Microvilli  | 微绒毛                   |
| middle cingulate cortex (MCC)                       | 中扣带皮层                 |
| Middle cranial fossa                                | 中颅窝                   |
| Midline nuclei                                      | 中线核                   |
| mid-subcallosal cingulate (Mid-SCC)                 | 中下胼胝体扣带皮层             |
| mild cognitive impairment (MCI)                     | 轻度认知损伤                |
| mind bindness                                       | 心智失明                  |
| miniature Excitatory PostSynaptic Potential (mEPSP) | 微兴奋性突触后电位             |
| miniaturizing glasses                               | 缩小镜                   |
| Minsky  | 明斯基                   |
| missense mutation                                   | 错义突变                  |
| mitogen-activated protein kinase (MAP kinase, MAPK) | 有丝分裂原活化蛋白激酶           |
| mitogen-activated/ERK kinase (MEK)                  | 有丝分裂原活化/<br>细胞外信号调节激酶 |
| Mitral cell   | 僧帽细胞                  |

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| Mitral cell  | 僧帽细胞        |
| Miyoshi myopathy   | 三好氏肌肉病变     |
| MK801  | 佐环平/地卓西平    |
| mm Hg  | 毫米汞柱        |
| Molecular Genetics   | 分子遗传学       |
| monoamine oxidase (MAO)  | 单胺氧化酶       |
| Montague   | 蒙太古         |
| Montreal Neurological Institute space (MNI)                      | 蒙特利尔神经研究所空间 |
| morpheme   | 词素          |
| Morris   | 莫里斯         |
| Mortimer Mishkin   | 莫蒂默·米什金     |
| mOsm   | 毫渗透摩尔       |
| Mossy fiber  | 苔藓纤维        |
| motor molecule   | 马达分子        |
| motor neurons (MN)   | 运动神经元       |
| motor primitives   | 运动基元        |
| motor protein  | 马达蛋白        |
| motor unit potentials (MUP)                                      | 运动单元电位波     |
| movement field   | 运动场         |
| movement-related neuron  | 运动相关神经元     |
| Mozart   | 莫扎特         |
| Muiishkin  | 梅希金         |
| Müllerian duct   | 副中肾管        |
| multiform layer  | 多形细胞层       |
| Multiple sclerosis   | 多发性硬化       |
| multivariate pattern analysis (MVPA)                             | 多元模式分析      |
| muscle tone  | 肌张力         |
| muscle-specific trk-related receptor with a kringle domain(MuSK) | 跨膜受体蛋白酪氨酸激酶 |
| Mushroom body  | 蕈体          |
| Müllerian inhibiting substance (MIS)                             | 副中肾管抑制物     |
| Müller glia  | 米勒胶质细胞      |
| Müller's muscle  | 米勒肌         |
| mustached bat  | 胡须蝙蝠        |

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| myasthenia gravis (MG)                     | 重症肌无力                |
| myelin basic protein (MBP)                 | 髓磷脂碱性蛋白              |
| myelinated axon                            | 有髓轴突                 |
| myelin protein zero (MPZ, P <sub>0</sub> ) | 髓磷脂零蛋白               |
| myelin-associated glycoprotein (MAG)       | 髓磷脂相关糖蛋白             |
| mygdala                                    | 杏仁核                  |
| mylohyoid muscle                           | 下颌舌骨肌                |
| Myosin heavy chain (MHC)                   | 肌球蛋白重链               |
| Myotonic dystrophy                         | 强直性肌营养不良             |
| Myotonin kinase                            | 肌 <del>肉</del> 质蛋白激酶 |
| Myotubular myopathy                        | 肌管性肌病                |
| Myotubularin                               | 肌微管素                 |
| M-wave                                     | 运动波                  |
| Nairan Ramirez-Esparza                     | 奈兰·拉米雷斯-埃斯帕扎         |
| Naja Ferjan Ramirez                        | 纳亚·费金·拉米雷斯           |
| Nancy Kanwisher                            | 南希·坎韦施               |
| nystagmus                                  | 眼球震颤                 |
| Nathaniel Kleitman                         | 纳撒尼尔·克莱特曼            |
| nativist                                   | 先天论者                 |
| Neal Cohen                                 | 尼尔·科恩                |
| Nebulin                                    | 伴肌动蛋白                |
| Necker cube                                | 内克尔立方体               |
| Nemaline rod myopathy                      | 杆状体肌病                |
| nebulin                                    | 伴肌动蛋白                |
| Needle electrode                           | 针状电极                 |
| nematode worm                              | 已知线虫                 |
| Neoendorphin                               | 新内啡肽                 |
| Nernst Equation                            | 能斯特方程                |
| nerve growth factor (NGF)                  | 神经生长因子               |
| Netrin                                     | 轴突导向因子               |
| neural apparatus                           | 神经组织                 |
| neural correlate                           | 神经相关物                |
| neurexins                                  | 神经外素                 |

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| neurofascin 186 (NF186)                  | 神经束蛋白 186  |
| neurofilament heavy polypeptide (NFH)    | 神经丝重多肽     |
| neurogenesis                             | 神经形成       |
| neurokinin-1 (NK1) receptor              | 神经激肽受体-1   |
| neuroligin 4X (NLGN4X)                   | 神经连接蛋白 4X  |
| Neuroligins (NLs)                        | 神经连接蛋白     |
| neurotransmitter sodium symporter (NSS)  | 神经递质钠转运体   |
| Neurotrophic Factors                     | 神经素营养因子    |
| neurotrophins (NT)                       | 神经营养物质     |
| neurulation                              | 神经胚形成      |
| neutralizing antibodies                  | 中和抗体       |
| New World monkey                         | 新大陆猴       |
| neural cell adhesion molecule (NCAM)     | 神经细胞粘附分子   |
| neural character                         | 神经特性       |
| neural crest                             | 神经脊        |
| neural decoding                          | 神经解码       |
| neural groove                            | 神经沟        |
| neural induction                         | 神经诱导       |
| neural substrate                         | 神经底物       |
| Neuroendocrine cell                      | 神经内分泌细胞    |
| Neurofilament light subunit              | 神经纤丝轻链亚基   |
| Neurogenin                               | 神经元素       |
| neuromodulators                          | 神经调质       |
| Neuronal cell adhesion molecule (NrCAM)  | 神经元细胞粘附分子  |
| neuropathies                             | 神经病变       |
| Neuropathic pain                         | 神经病理性疼痛    |
| neuropeptide receptor (npr)              | 神经肽受体      |
| neuropeptide Y (NPY)                     | 神经肽 Y      |
| neuropil                                 | 神经胶质细胞     |
| neuropilins                              | 神经轴突指导分子   |
| nicotinamide adenine dinucleotide (NADH) | 烟酰胺腺嘌呤二核苷酸 |
| nicotinamide mononucleotide              | 烟酰胺单核苷酸    |
| adenyltransferase 1 (NMNAT1)             | 腺嘌呤转移酶 1   |
| nicotinic receptor (nic)                 | 烟碱受体       |

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| Nigel Unwin  | 奈杰尔·昂温       |
| Nils Hillarp   | 尼尔斯·希勒       |
| Nima Ghitani   | 尼姆·基塔尼       |
| Nissl substance  | 尼氏体          |
| nitric oxide (NO)                                      | 一氧化氮         |
| Noam Chomsky   | 诺姆·乔姆斯基      |
| Node of Ranvier  | 郎飞结          |
| noggin   | 头蛋白          |
| Nogo   | 勿动蛋白         |
| Nonassociative learning                                | 非联想学习        |
| nonsense mutation                                      | 无义突变         |
| Nonspindle endings                                     | 非梭形末梢        |
| nonsteroidal anti-inflammatory drugs (NSAIDs)          | 非甾体抗炎药       |
| Non-coding RNA (ncRNA)                                 | 非编码核糖核酸      |
| non-voltage-activated sodium leak nonselective (NALCN) | 非电压激活钠泄漏非选择性 |
| noradrenaline  | 去甲肾上腺素       |
| noradrenergic (NA)                                     | 去甲肾上腺素能      |
| noradrenergic neurons (A1)                             | 去甲肾上腺素能神经元   |
| norepinephrine (NE)                                    | 去甲肾上腺素       |
| norepinephrine transporter (NET)                       | 去甲肾上腺素转运蛋白   |
| Normetanephrine (NM)                                   | 去甲肾上腺素       |
| Neuropeptide Y Receptor Type 2 (Npy2r)                 | 神经肽Y受体2      |
| Nuclear envelope                                       | 核被膜          |
| nuclear import receptors                               | 核输入受体        |
| Nucleus accumbens (NAcc)                               | 伏隔核          |
| nucleus ambiguus                                       | 疑核           |
| nucleus of Darkshevich                                 | 达克谢维奇核       |
| nucleus of the solitary tract (NST, NTS)               | 孤束核          |
| nucleus prepositus hypoglossi                          | 舌下前置核        |
| nucleus raphe magnus                                   | 大中缝核         |
| nucleus reticularis magnocellularis (NRMc)             | 大细胞网状核       |
| nucleus reticularis gigantocellularis (NRGc)           | 巨细胞网状核       |

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|---|---------------------|
| nucleus reticularis pontis oralis (NRPo)                    | 网状脑桥嘴核              |
| nucleus subceruleus   | 蓝斑下核                |
| N-arachidonylphosphatidylethanolamine<br>(N-arachidonyl PE) | N-花生四烯酸磷脂酰乙醇胺       |
| N-ethylmaleimide-sensitive fusion protein (NSF)             | N-乙基顺丁烯二酰亚胺敏感性的融合蛋白 |
| N-methyl-4-phenylpyridinium (MPP <sup>+</sup> )             | N-甲基-4-苯基吡啶         |
| N-Methyl-D-Aspartate (NMDA)                                 | N-甲基-D-天冬氨酸         |
| N-terminal domain   | N-末端结构域             |
| object-vector cell  | 目标向量细胞              |
| obsessive-compulsive disorder                               | 强迫症                 |
| occipitotemporal cortex                                     | 枕颞皮层                |
| ocular motor nerve  | 动眼神经                |
| oculocutaneous albinism II (OCA2)                           | 2型眼皮肤白化病            |
| Oculomotor nerve (oculomotor)                               | 动眼神经                |
| oculomotor vermis (OMV)                                     | 动眼神经小脑蚓体            |
| Oculopharyngeal dystrophy                                   | 眼咽型肌营养不良            |
| Odorant   | 气味剂                 |
| Oedipus at Colonus  | 俄狄浦斯在科罗诺斯           |
| OFF Cell  | 撤光细胞                |
| FMB midget bipolar (IMB)                                    | 撤光侏儒双极细胞            |
| Old World monkeys   | 旧大陆猴                |
| olfactory bulb (OB)   | 嗅球                  |
| olfactory cortex  | 嗅觉皮层                |
| olfactory epithelium  | 嗅上皮                 |
| olfactory marker protein                                    | 嗅觉标记蛋白              |
| olfactory sensory neurons                                   | 嗅觉感受神经元             |
| olfactory tract   | 嗅束                  |
| olfactory tubercle  | 嗅结节                 |
| oligodendrocyte   | 少突胶质细胞              |
| Oliver Selfridge  | 奥利弗·塞尔弗里奇           |
| olivary pretectal nucleus                                   | 橄榄顶盖前核              |
| oligodendrocyte-myelin<br>glycoprotein (OMgp)               | 髓鞘少突胶质细胞糖蛋白         |
| omnipause neurons   | 全面停止神经元             |

|                                      |           |
|--------------------------------------|-----------|
| ON Cell                              | 给光细胞      |
| ON midget bipolar (IMB)              | 给光侏儒双极细胞  |
| Onuf' s nucleus (Onufrowicz nucleus) | 奥奴弗罗维奇核   |
| oocyte                               | 卵母细胞      |
| operant conditioning                 | 操作性条件反射   |
| open reading frame (ORF)             | 开放阅读框     |
| ophthalmic division ( $V_1$ )        | 视分支       |
| opposite direction (OD)              | 反向        |
| optic chiasm (OC)                    | 视交叉       |
| Optic foramen                        | 视神经孔      |
| optic nerve                          | 视神经       |
| optimal linear estimator (OLE)       | 最佳线性估计器   |
| optokinetic response                 | 眼动响应      |
| orbital frontal cortex (OFC, OF11)   | 眶额皮层      |
| orexin                               | 食欲素       |
| Orexinergic Neurons                  | 促食欲素能神经元  |
| organism biology                     | 有机体生物学    |
| organizer                            | 组织者细胞     |
| organizer region                     | 组织区       |
| Orphan receptor                      | 孤儿受体      |
| Orphanin FQ                          | 孤啡肽       |
| Ortrud Steinlein                     | 奥特鲁·施泰因莱因 |
| ossicles                             | 听小骨       |
| Oswald Steward                       | 奥斯卡·斯图尔德  |
| otoacoustic emissions                | 耳声发射      |
| otoferlin                            | 耳畸蛋白      |
| Otto Loewi                           | 奥托·勒维     |
| ouabain                              | 哇巴因       |
| outer fiberlayer (OFL)               | 外纤维层      |
| outer subventricular zone (OSVZ)     | 室下外侧区     |
| outsider artist                      | 世外艺术家     |
| oval window                          | 卵圆窗       |
| overcorrection                       | 过度矫正      |

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|--|--------------|
| owl monkey   | 夜猴           |
| oxygen debt  | 氧债           |
| oxygen saturation ( $SaO_2$ )                        | 血氧饱和度        |
| oxytocin (OXY)                                       | 催产素          |
| O'Keefe  | 奥吉弗          |
| P element  | P 元件         |
| Pablo Picasso  | 巴勃罗·毕加索      |
| pacemaker potential                                  | 起搏电位         |
| Pacinian corpuscle                                   | 环层小体, 帕西尼安小球 |
| Paired helical filaments                             | 双螺旋丝         |
| paired-association task                              | 配对偶联任务       |
| Papio papio  | 几内亚狒狒        |
| papillary ridge                                      | 乳头脊          |
| parabrachial nucleus (parabrachial nuclei, PB)       | 臂旁核          |
| parafacial zone (PFZ)                                | 面神经旁核        |
| parafascicular thalamic nucleus                      | 丘脑束旁核        |
| parahippocampal cortex (PHC)                         | 海马旁回         |
| parahippocampal place area (PPA)                     | 海马旁回         |
| parahippocampal gyrus (Ph)                           | 海马旁回         |
| Parallel fiber (PF)                                  | 平行纤维         |
| paramedian pontine reticular formation (PPRF)        | 脑桥旁正中网状结构    |
| Paranodal loop (PNL)                                 | 帕拉节环         |
| parasomnias  | 异态睡眠         |
| paraspinals (PSP)                                    | 椎旁肌          |
| parasubiculum  | 旁下托          |
| paraventricular hypothalamus                         | 下丘脑室旁        |
| paraventricular nucleus                              | 旁室核          |
| paraventricular nucleus of<br>the hypothalamus (PVH) | 下丘脑室旁核       |
| Paraxial mesoderm                                    | 轴旁中胚层        |
| parentese  | 父母语          |
| parental behavior                                    | 养育行为         |
| parent-child trios                                   | 亲子三人组        |
| Paired box gene 6 (Pax6)                             | 配对盒基因 6      |

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|--|------------|
| parietal areas (PE)                          | 顶叶         |
| Parietal reach region (PRR)                  | 顶叶到达区      |
| parietal rostroventral cortex (PR)           | 顶叶头腹侧皮层    |
| parietal ventral cortex (PV)                 | 顶叶腹侧皮层     |
| parieto-insular vestibular cortex (PIVC)     | 顶-岛前庭皮层    |
| parieto-occipital sulcus area 2 (POS2)       | 顶枕沟 2 区    |
| Parkinson disease (PD)                       | 帕金森病       |
| paroxysmal depolarizing shift (PDS)          | 阵发性去极化漂移   |
| partial pressure of oxygen ( $\text{PO}_2$ ) | 血氧分压       |
| partisans                                    | 坚定的支持者     |
| parvalbumin (PV)                             | 小清蛋白       |
| patch  | 斑块         |
| patchclamp amplifier                         | 膜片钳放大器     |
| passive force                                | 被动力        |
| patellar tendon                              | 髌腱         |
| Patrick Haggard                              | 帕特里克·哈格德   |
| Patrick Wall                                 | 帕特里克·沃尔    |
| pattern completion                           | 模式完成       |
| Paul Bucy                                    | 保罗·布西      |
| Paul Ehrlich                                 | 保罗·埃尔利希    |
| Paul Fatt                                    | 保罗·法特      |
| Paul Gaugin                                  | 保罗·高更      |
| Paul Greengard                               | 保罗·格林加德    |
| Paul Hoffmann                                | 保罗·霍夫曼     |
| Paul Iverson                                 | 保罗·艾弗森     |
| Paul Lauterbur                               | 保罗·劳特布尔    |
| Paul MacLean                                 | 保罗·麦克莱恩    |
| Paul Mueller                                 | 保罗·穆勒      |
| Paul Pierre Broca                            | 皮埃尔·保尔·布洛卡 |
| Paul Weiss                                   | 保罗·韦斯      |
| Paul Wender                                  | 保罗·文德      |
| Pavlovian conditioning                       | 巴甫洛夫条件反射   |
| PE intraparietal area (PEip)                 | 顶内区        |

|   |                 |
|---|-----------------|
| pectoralis (Pec)                                | 胸肌              |
| pedunculopontine nucleus (PPN)                  | 脑桥脚核            |
| pedunculopontine tegmental nucleus (PPT)        | 脚桥被盖核           |
| Pelizaeus-Merzbacher disease                    | 佩梅病             |
| Peltier   | 帕尔贴             |
| penetrating intracortical electrode             | 穿透性皮层内电极        |
| pentameric ligand-gated ion channels (pLGIC)    | 五聚体配体门控离子通道     |
| peptide YY (PYY)                                | 多肽 YY           |
| PER protein                                     | 周期蛋白            |
| per gene (per)                                  | 节律基因            |
| percentage of maximum score possible (POMP)     | 可能的最大分数百分比      |
| perceptual constancy                            | 知觉恒常性           |
| perceptual null point                           | 感知零点            |
| perforant pathway                               | 穿质通路            |
| periaqueductal gray matter (PAG)                | 中脑导水管周围灰质       |
| Periaxin  | 轴周蛋白            |
| Periglomerular cell                             | 球周细胞            |
| Perineurial sheath                              | 神经鞘             |
| perinodal astroglial processes (PNP)            | 神经结节周围的星状胶质细胞突起 |
| Period genes (Per)                              | 周期基因            |
| peripheral myelin protein 22 (PMP22)            | 外周鞘磷脂蛋白 22      |
| peripheral nervous system                       | 周围神经系统          |
| peristimulus time histogram                     | 刺激时间直方图         |
| perisylvian language area (PSL)                 | 外侧裂周语言区         |
| peroneal myopathy<br>(Charcot-Marie-Tooth, CMT) | 遗传性神经性肌萎缩       |
| Peter Agre                                      | 彼得·阿格雷          |
| Peter Eimas                                     | 彼得·艾马斯          |
| Peter Halligan                                  | 彼得·哈里根          |
| Peter Mansfield                                 | 彼得·曼斯菲尔德        |
| Peter Strick                                    | 彼得·斯特里克         |
| petit mal                                       | 癫痫小发作           |

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|--|--------------------|
| Petrides   | 佩特里迪斯              |
| petrosal ganglion  | 岩神经节               |
| petrous temporal bone  | 颞骨岩                |
| Peucetian women  | 佩塞特妇女              |
| phasic dopamine  | 相位性多巴胺             |
| phencyclidine (angel dust, PCP)                                | 苯环利定, 天使尘          |
| Phenoxybenzamine   | 酚苄明                |
| Phenylalanine (Phe)  | 苯丙氨酸               |
| Phenylketonuria (PKU)  | 苯丙酮尿 (苯丙酮尿症)       |
| pheromone  | 信息素                |
| Philip Bard  | 菲利普·巴德             |
| Phineas Gage   | 菲尼斯·盖奇             |
| Phonetic unit  | 语音单位               |
| Phosphatase and tensin homolog (PTEN)                          | 蛋白酪氨酸磷酸酶基因         |
| phosphate-activated glutaminase (PAG)                          | 磷酸激活的谷氨酰胺酶         |
| phosphatidylinositol (PI)                                      | 磷脂酰肌醇              |
| phosphatidylinositol<br>4,5-bisphosphate ( $PIP_2$ )           | 磷脂酰肌醇-4,5-二磷酸      |
| phosphatidylinositol-3 kinase (PI3-K)                          | 磷酸肌醇 3-激酶          |
| phosphoinositide3-kinase (PI3K)                                | 磷酸肌醇 3-激酶          |
| phospholipase A <sub>2</sub> (PLA <sub>2</sub> )               | 磷脂酶 A <sub>2</sub> |
| phospholipase C (PLC)  | 磷脂酶C               |
| phospholipase D (PLD)  | 磷脂酶D               |
| phosphoprotein phosphatase 1 (PP1)                             | 磷蛋白磷酸酶 1           |
| photoreceptors   | 光感受器               |
| physiognomy  | 相面术                |
| Pial surface   | 软脑膜表面              |
| Pierre Broca   | 皮埃尔·布洛卡            |
| Pierre Flourens  | 皮埃尔·弗卢龙            |
| Pierre Fournier  | 皮埃尔·富尔纳雷           |
| piezo type mechanosensitive ion<br>channel component 1, Piezol | 压电型机械敏感离子通道组件 1    |
| piloerection   | 寒毛直立               |
| Ping Mamiya  | 平·玛米亚              |

|                                 |                       |
|---------------------------------|-----------------------|
| Pioneer neuron                  | 先驱神经元                 |
| Piriform cortex                 | 梨状皮层                  |
| Pittsburgh compound B           | 匹兹堡化合物 B              |
| Pituitary gland                 | 垂体腺                   |
| PIWI-interacting RNA<br>(piRNA) | 与 Piwi 蛋白相作用<br>的核糖核酸 |
| pku                             | 苯丙酮尿症基因               |
| place cell                      | 位置细胞                  |
| place field                     | 位置场                   |
| plasma membrane                 | 细胞质膜                  |
| Plato                           | 柏拉图                   |
| Plectin                         | 网蛋白                   |
| Plexin                          | 丛蛋白                   |
| phosphodiesterase (PDE)         | 磷酸二酯酶                 |
| phyla                           | 门                     |
| polymorphic layer               | 多形层                   |
| poly(A) tail                    | 多 A 尾                 |
| positive allosteric modulator   | 正变构调节剂                |
| posterior belly                 | 后腹                    |
| posterior canal                 | 后半规管                  |
| posterior column                | 脊髓后柱                  |
| posterior parietal cortex (PP)  | 后顶叶皮层                 |
| prednisolone                    | 泼尼松龙                  |
| preferred direction             | 偏好方向                  |
| premotor area                   | 前运动区                  |
| premotor cortex                 | 前运动皮层                 |
| preplate                        | 前皮层板                  |
| presubiculum                    | (海马) 前下托              |
| pre-Bötzinger complex           | 前包钦格复合体               |
| primary somatosensory cortex    | 初级体感皮层                |
| priority map                    | 优先级映射                 |
| prognosis                       | 预断                    |
| progressive supranuclear palsy  | 进行性核上性麻痹              |
| prostigmine                     | 普洛斯的明                 |

|   |                        |
|---|------------------------|
| protofibrils                                  | 原纤维                    |
| protooncogene src                             | 原癌肉瘤基因                 |
| PTEN-induced putative kinase 1 (PINK1)        | 蛋白酪氨酸磷酸酶基因<br>诱导假定激酶 1 |
| point mutation                                | 点突变                    |
| Poly A binding protein                        | 多聚腺苷酸结合蛋白              |
| polygenic risk scores (PRS)                   | 多基因风险评分                |
| polymerase (Pol)                              | 聚合酶                    |
| Polymodal                                     | 多觉型                    |
| polymodal nociceptor                          | 多觉型伤害性感受器              |
| polymorphism                                  | 多态性                    |
| polysomnogram                                 | 多导睡眠图                  |
| pontine flexure                               | 桥曲                     |
| pontine micturition center (PMC)              | 脑桥排尿中枢                 |
| positron emission tomography (PET)            | 正电子发射断层成像              |
| posterior commissure                          | 后连合                    |
| Posterior cranial fossa                       | 后颅窝                    |
| posterior group                               | 后侧核群                   |
| Posterior Parietal Cortex (PPC)               | 后顶叶皮层                  |
| postsynaptic density (PSD)                    | 突触后致密物                 |
| postsynaptic density 95 (PSD-95)              | 突触后密度蛋白 95             |
| postural tone                                 | 姿势性张力                  |
| pontine nuclei (PN)                           | 脑桥核                    |
| pontomedullary reticular formation (PMRF)     | 桥髓网状结构                 |
| population vector algorithm (PVA)             | 群体向量法                  |
| Positive and Negative Affect Schedule (PANAS) | 正性负性情绪量表               |
| posterior superior temporal gyri              | 上颞回后部                  |
| postrolateral fissure                         | 后外侧裂                   |
| Postganglionic neurons                        | 节后神经元                  |
| posttraumatic stress disorder (PTSD)          | 创伤后应激障碍                |
| potassium-aggravated myotonia                 | 钾加重性肌强直                |
| potential postsynaptic                        | 突触后电位                  |
| Prader-Willi syndromes                        | 小胖威利症                  |

|   |           |
|---|-----------|
| Prechordal plate                            | 脊索前板      |
| predorsal premotor cortex (pre-PMd)         | 背前前运动皮层   |
| prefrontal cortex (F46)                     | 前额叶皮层     |
| Preganglionic neurons                       | 节前神经元     |
| Preganglionic autonomic motor neurons (PGC) | 节前自主运动神经元 |
| prelimbic cortex                            | 前边缘皮层     |
| Premature stop codon                        | 提前终止密码子   |
| preoptic area (POA)                         | 视前区       |
| Presenilin-1 (PS1)                          | 早老蛋白-1    |
| prestin                                     | 快蛋白       |
| presupplementary motor area (pre-SMA)       | 前辅助运动区    |
| Presynaptic terminal                        | 突触前末梢     |
| Pretectum                                   | 前顶盖       |
| pre-supplementary motor area (Pre-SMA)      | 前辅助运动区    |
| Primary active transport                    | 初级主动运输    |
| primary fissure (PF)                        | 原裂        |
| primary motor cortex (M1)                   | 初级运动皮层    |
| primary somatosensory cortex (S-I, S1)      | 初级躯体感觉皮层  |
| Primary spindle ending                      | 初级梭形末梢    |
| Priming                                     | 启动        |
| principal sulcus (PS)                       | 主沟        |
| principle of dynamic polarization           | 动态极化原理    |
| Principles of Psychology                    | 《心理学原理》   |
| principal sensory trigeminal nucleus        | 三叉神经感觉主核  |
| prokaryote                                  | 原核生物      |
| Prolactin release-inhibiting hormone (PIH)  | 催乳素分泌抑制因子 |
| prodynorphin (PDYN)                         | 前强啡肽      |
| proenkephalin (PENK)                        | 前脑啡肽      |
| profilin                                    | 抑制蛋白      |
| progenitor cell (P)                         | 祖细胞       |
| Projection interneuron                      | 投射中间神经元   |
| proneurotrophins                            | 神经营养素     |
| proopiomelanocortin (POMC)                  | 前阿黑皮素     |

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|--|--------------------|
| proposition  | 主张                 |
| proprioceptors   | 本体感受器              |
| Prostaglandin  | 前列腺素               |
| Prostigmin   | 新斯的明               |
| prosopagnosia  | 面孔失认症              |
| protein kinase A (PKA)   | 蛋白激酶 A             |
| protein kinase B (PKA, Akt)  | 蛋白激酶 B             |
| protein kinase C (PKC)   | 蛋白激酶 C             |
| protein kinase M $\zeta$ (PKM $\zeta$ )                                    | 蛋白激酶 M $\zeta$     |
| protein-O-mannosyl transferase 1 (POMT1)                                   | 蛋白 O-甘露糖基转移酶 1     |
| protein-Omannosyl $\alpha$ -, 2-N-acetylglucosaminyl transferase (POMGnT1) | N-乙酰氨基葡萄糖-甘露糖转移酶 1 |
| proteoglycan   | 蛋白聚糖               |
| proteolipid protein (PLP)  | 蛋白脂蛋白              |
| proteome   | 蛋白质组               |
| protocadherin (Pcdh)   | 原钙粘蛋白              |
| protopathic system   | 粗感觉系统              |
| proximal myotonic dystrophy  | 近端肌强直性肌病           |
| proximal phalanges   | 近端指骨               |
| proximity  | 邻近性                |
| pruritogens  | 致痒素                |
| Posttetanic potentiation   | 强直刺激后增强            |
| primary auditory cortex (A1)   | 初级听觉皮层             |
| prolactin (PRL)  | 催乳素                |
| pro-opiomelanocortin (POMC)  | 前阿黑皮素              |
| pS   | 皮西门子               |
| psychometric function  | 心理测量函数             |
| pteridine (Pt)   | 蝶啶                 |
| Ptf1a  | 胰腺特异转录因子 1A        |
| pulses per second (pps)  | 每秒脉冲数              |
| Pulvinar   | 丘脑枕                |
| pulvinar nucleus (PL)  | 枕核                 |

|   |                |
|---|----------------|
| pupillary light reflexes                                  | 瞳孔光反射          |
| pure tone   | 纯音             |
| Purkinje cell (PC)  | 浦肯野细胞          |
| Purinergic Receptor P2Y1 (P2ry1)                          | 嘌呤能受体 P2Y1     |
| putamen (Put, PUT)  | 壳核             |
| pyloric (PY)  | 幽门             |
| pyloric dilator (PD)                                      | 幽门扩张器          |
| pyramidal cell  | 锥体细胞           |
| pyramidal decussation                                     | 锥体交叉           |
| pyramidal motor system                                    | 锥体运动系统         |
| pyramidal neurons   | 锥体神经元          |
| pyramidal tracts  | 锥体束            |
| pyriform cortex   | 梨状皮层           |
| quadriceps (QUAD)   | 四头肌            |
| quantitative magnetic resonance imaging (qMRI)            | 定量磁共振成像        |
| rab-interacting molecules (RIMs)                          | Rab 相互作用分子     |
| rab-interacting molecules binding protein (RIM-BP)        | Rab 相互作用分子结合蛋白 |
| radiofrequency (RF)                                       | 射频             |
| Ragnar Granit   | 拉格纳·格拉尼特       |
| Ramus communicantes                                       | 连通分支           |
| Ranulfo Romo  | 拉努尔福·罗莫        |
| Randy Flanagan  | 兰迪·弗拉纳根        |
| raphe nuclei  | 中缝核            |
| raphe obscurus nuclei                                     | 不定中缝核          |
| raphe pallidus nuclei                                     | 苍白中缝核          |
| rapid eye movement (REM)                                  | 快速眼动           |
| rapidly adapting (RA)                                     | 快适应            |
| rapidly adapting low-threshold mechanoreceptors (RALTMRs) | 快适应低阈值机械感受器    |
| rapsyn  | 受体相连突触蛋白       |
| Rare Mutation   | 罕见突变           |
| rat sarcoma (Ras)   | 大鼠肉瘤           |
| rate-limiting factor                                      | 限速因子           |

|   |            |
|---|------------|
| rectifying synapses   | 矫正突触       |
| Raymond Dodge   | 雷蒙德·道奇     |
| reaction time   | 响应时间       |
| rearranged during transfection (Ret, RET)                           | 转染重排       |
| recalibrated feedback intention-trained                             | 重新校准反馈意图   |
| Kalman filter (RF)  | 训练卡尔曼滤波器   |
| receiver operating characteristic (ROC)                             | 受试者工作特征    |
| receptive element   | 受体元件       |
| Receptive Field (RF)  | 感受野        |
| receptor for advanced glycation end products (RAGE)                 | 晚期糖基化终产物受体 |
| Receptor potential  | 受体电位       |
| Receptor tyrosine kinase  | 受体酪氨酸激酶    |
| recombination   | 基因重组       |
| reconsolidation   | 再巩固        |
| recruitment   | 募集         |
| rectus muscle   | 直肌         |
| Reelin  | 络丝蛋白       |
| reelin protein  | 络丝蛋白       |
| reentrant loop  | 可重入回路      |
| regional cerebral metabolic rate for glucose (rCMR <sub>glc</sub> ) | 区域大脑葡萄糖代谢率 |
| regions of interest (ROI)   | 感兴趣区域      |
| regulatory subunit (R)  | 调节亚基       |
| Reissner's membrane   | 前庭膜        |
| relay line  | 中继线        |
| relay neuron  | 中继神经元      |
| Rene Descartes (René Descartes)                                     | 勒内·笛卡尔     |
| Renshaw cell  | 闰绍细胞       |
| Repetitive Transcranial Magnetic Stimulation                        | 重复经颅磁刺激    |
| representational similarity analysis (RSA)                          | 表征相似性分析    |
| Rescorla Wagner model   | 雷斯科拉-瓦格纳模型 |
| Reserpine   | 利血平        |
| response field (RF)   | 响应场        |

|  |            |
|--|------------|
| responsive neurostimulation system (RNS) | 响应神经刺激系统   |
| restiform body                           | 绳状体        |
| REST/NRSF                                | 神经元限制性沉默因子 |
| restriction endonuclease                 | 限制性核酸内切酶   |
| reticular nucleus of the thalamus (RT)   | 丘脑网状核      |
| reticulospinal tracts (RST)              | 网状脊髓束      |
| Retinal ganglion cells (RGC)             | 视网膜神经节细胞   |
| retinotopic map                          | 视网膜映射      |
| retrograde amnesia                       | 逆行遗忘       |
| retrosplenial complex (RSC)              | 压后皮层复合体    |
| retrosplenial cortex                     | 压后皮层       |
| retrotrapezoid neuron                    | 斜方体后神经元    |
| Rett syndrome                            | 雷特综合症      |
| reversal learning                        | 反转学习       |
| reward prediction error (RPE)            | 奖励预测误差     |
| rhodopsin (R)                            | 视紫红质       |
| rhombomere                               | 菱脑节        |
| Rhythm-generating extensor (eR)          | 产生节律的伸肌    |
| Rhythm-generating flexor (fR)            | 产生节律的屈肌    |
| Ribonucleic Acid                         | 核糖核酸       |
| Ribonucleic Acid interference (RNAi)     | 核糖核酸干扰     |
| ribonuclease                             | 核糖核酸酶      |
| Ribosomal RNA (rRNA)                     | 核糖体核糖核酸    |
| Richard Andersen                         | 理查德·安德森    |
| Richard Bagnall                          | 理查德·巴格诺尔   |
| Richard Ivry                             | 理查德·伊夫里    |
| Richard L. Gregory                       | 理查德·格里高利   |
| Richard Morris                           | 理查德·莫里斯    |
| Richard Thompson                         | 理查德·汤普森    |
| Richard Semon                            | 理查德·西蒙     |
| Richard Wagner                           | 理查德·瓦格纳    |
| right CPG (rF)                           | 右中枢模式发生器   |
| right flexor (rF)                        | 右屈肌        |

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|--|-------------|
| right flexor motor neurons (rFmn)        | 右屈肌运动神经元    |
| right forelimb (RFL)                     | 右前肢         |
| right hemisphere (RH)                    | 右半球         |
| right hindlimb (RHL)                     | 右后肢         |
| Rigid spine syndrome                     | 脊柱强直综合症     |
| Rinné test                               | 林纳试验        |
| Rio Hortega                              | 瑞鸥·霍特加      |
| rippling muscle disease                  | 波纹肌病        |
| Rita Levi-Montalcini                     | 丽塔·列维-蒙塔尔奇尼 |
| RNAse H                                  | 核糖核酸酶 H     |
| RNA-binding protein                      | 核糖核酸结合蛋白    |
| Roberta Klatzky                          | 罗伯塔·克莱兹基    |
| Robert Burton                            | 罗伯特·波顿      |
| Robert Edwards                           | 罗伯特·爱德华     |
| Robert Lockhart                          | 罗伯特·洛哈特     |
| Roberto Malinow                          | 罗伯托·马利诺     |
| Robert Shprintzen                        | 罗伯托·什普林茨恩   |
| Robert Stickgold                         | 罗伯特·史蒂克戈德   |
| Rod MacKinnon                            | 罗德·麦金农      |
| Rodolfo Llinás                           | 鲁道夫·利纳斯     |
| robust nucleus of the archistriatum (RA) | 古纹状体强健核     |
| Rodolfo Llinas                           | 鲁道夫·伊利纳斯    |
| rod bipolar (RB)                         | 杆状双极细胞      |
| rod cell                                 | 视杆细胞        |
| Roger Albin                              | 罗杰·阿尔宾      |
| Roland Johansson                         | 罗兰·约翰逊      |
| Ron Harris-Warrick                       | 罗恩·哈里斯-瓦里克  |
| Ron Rensink                              | 罗恩·伦辛克      |
| René Spitz                               | 雷诺·史必兹      |
| Roger Guillemin                          | 罗杰·吉莱明      |
| Roger Sperry                             | 罗杰·斯佩里      |
| Ronald Melzack                           | 罗纳德·梅尔扎克    |
| roof plate cell                          | 顶板细胞        |

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|-------------------------------------|-----------------------|
| Rootlet                             | 小根                    |
| Ross Harrison                       | 罗斯·哈里逊                |
| Rossetti                            | 罗塞蒂                   |
| Rostral auditory cortex (R)         | 嘴侧听觉皮层                |
| rostral migratory stream            | 嘴侧迁移流                 |
| RostrotTemporal auditory cortex (R) | 前颞听觉皮层                |
| rough endoplasmic reticulum (RER)   | 糙面内质网                 |
| round window                        | 圆窗                    |
| Rubin figure                        | 花瓶与人脸交变图              |
| Rubinstein-Taybi syndrome           | 阔拇指综合症,<br>鲁宾斯坦-泰比综合症 |
| Rubrospinal tract                   | 红核脊髓束                 |
| Rudolph Leibel                      | 鲁道夫·利贝尔               |
| Ruffini ending                      | 鲁菲尼终末器                |
| rutabaga gene                       | 大头菜基因                 |
| Ruvo di Puglia                      | 鲁沃迪普利亚                |
| ryanodine receptor                  | 雷诺丁受体                 |
| saccadic                            | 眼跳                    |
| saccharin preference (Sac)          | 糖精偏好                  |
| saccule                             | 球囊                    |
| sagittal plane                      | 矢状面                   |
| salience map                        | 显著性映射                 |
| Sally-Anne test                     | 萨莉-安妮测试               |
| saltatory conduction                | 跳跃式传导                 |
| Sanford Palay                       | 桑福德·帕莱                |
| Sanger Brown                        | 桑各·布朗                 |
| Santiago Ramony Cajal               | 圣地亚哥·拉蒙·卡哈尔           |
| Sarah Wilson                        | 莎拉·威尔逊                |
| sarcomere length                    | 肌节长度                  |
| Sarcoplasmic reticulum              | 肌质网                   |
| sartorius                           | 缝匠肌                   |
| savant syndrome                     | 学者综合症                 |
| scala media                         | 中阶                    |
| Scala tympani                       | 鼓阶                    |

|   |             |
|---|-------------|
| Scala vestibuli                           | 前庭阶         |
| Scarpa's ganglia                          | 斯卡帕神经节      |
| Schenker                                  | 辛克          |
| Schmahmann                                | 施马曼         |
| Schmidt                                   | 施密特         |
| Secondary active transport                | 次级主动运输      |
| secondary antibodies                      | 二抗          |
| secondary somatosensory cortex (S-II, S2) | 次级躯体感觉皮层    |
| Secondary spindle ending                  | 次级梭形末梢      |
| selective serotonin                       | 选择性 5-羟色胺   |
| reuptake inhibitors (SSRI)                | 再吸收抑制剂      |
| semaphorin                                | 信号素         |
| semicircular canal                        | 半规管         |
| sensor molecule                           | 受体分子        |
| sensorineural hearing loss                | 感音神经性聋      |
| sensory threshold                         | 受体分子        |
| sequestosome 1                            | 选择性自噬接头蛋白 1 |
| Serous gland                              | 浆液腺         |
| settle                                    | 安置          |
| Schaffer collateral pathway               | 谢弗侧支        |
| Schenck                                   | 申克          |
| schizophrenia                             | 精神分裂症       |
| Schwann cell                              | 施旺细胞        |
| Scott Sternson                            | 斯科特·斯特内森    |
| William Scoville                          | 威廉·斯科维尔     |
| Secondary generalization                  | 次级泛化        |
| Seizure focus                             | 致痫灶         |
| Selenoprotein                             | 硒蛋白         |
| self-excitation                           | 自我激励        |
| sensitization                             | 致敏作用        |
| sensorimotor transformation               | 感觉-运动转换     |
| sensory modality                          | 感觉模态        |
| sensory prediction error                  | 感觉运动误差      |
| serine (Ser)                              | 丝氨酸         |

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|---|-----------------------|
| serotonergic neuron                                       | 5-羟色胺能神经元             |
| serotonin reuptake transporter                            | 5-羟色胺再摄取转运蛋白          |
| serotonin transporter                                     | 5-羟色胺转运蛋白             |
| set domain containing 1A (SETDIA)                         | 组蛋白 H3 赖氨酸 4 特异性甲基转移酶 |
| settling point model                                      | 稳定点模型                 |
| sex-determining region on Y (SRY)                         | Y 染色体性别决定区            |
| sex-linked inheritance                                    | 伴性遗传                  |
| Sexual dimorphism   | 两性异形                  |
| sexually dimorphic nucleus of the preoptic area (SDN-POA) | 视前区性二态核团              |
| Seymour Benzer  | 西摩·本泽                 |
| Seymour Kety  | 西摩·凯帝                 |
| sharp-wave ripples (SWRs)                                 | 尖波涟漪                  |
| shell shock   | 战斗疲劳症                 |
| Shereshevski  | 舍雷舍夫斯                 |
| Sherlock Holmes   | 夏洛克·福尔摩斯              |
| shiverer  | 颤抖                    |
| Short-term facilitation                                   | 短时程易化                 |
| Shosaku Numa  | 沼正作                   |
| sickle cell anemia  | 镰状细胞贫血                |
| Sid Kouider   | 西德·欧伊德                |
| Sidney Ochs   | 西德尼·奥克斯               |
| Short-term facilitation                                   | 短时程易化                 |
| sigmoid bone  | S型骨                   |
| Sigmund Freud   | 西格蒙德·弗洛伊德             |
| signaling units   | 信号单元                  |
| silent mutation   | 沉默突变                  |
| silent nociceptor   | 寂静性伤害性感受器             |
| Silent synapse  | 静寂突触                  |
| single nucleotide polymorphism                            | 单核苷酸多态性               |
| single-photon emission computed tomography (SPECT)        | 单光子发射计算机断层扫描          |
| sirtuins  | 乙酰化酶                  |

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|---|-------------------------|
| sitter larvae   | 保姆幼虫                    |
| size constancy  | 大小恒常性                   |
| size-weight illusion  | 大小-重量错觉                 |
| skelemins   | 骨架蛋白                    |
| sleep apnea, cessation of breathing                                     | 睡眠呼吸暂停                  |
| sleep-promoting neuron  | 睡眠促进神经元                 |
| Sliman Bensmaia   | 斯利曼·本斯曼                 |
| Slowly adapting (SA)  | 慢适应                     |
| slow-wave sleep (SWS)   | 慢波睡眠                    |
| slug  | 鼻涕虫分子                   |
| SM protein  | 血清粘蛋白                   |
| small conductance calcium-activated potassium channel<br>(SK channel)   | 小电导钙激活K <sup>+</sup> 通道 |
| small noncoding RNA   | 小非编码核糖核酸                |
| small nuclear RNA (snRNA)   | 小核核糖核酸                  |
| Snail   | 蜗牛分子                    |
| Social anxiety disorder   | 社交焦虑症                   |
| Social Avoidance and Distress Scale                                     | 社交回避及苦恼量表               |
| social memory   | 社交记忆                    |
| soleus muscle   | 比目鱼肌                    |
| solitary nucleus  | 孤束核                     |
| soluble N-ethylmaleimide-sensitive factor attachment receptors (SNAREs) | 可溶性N-乙基马来酰亚胺敏感因子附着受体    |
| Somatosensory cortex  | 体感皮层                    |
| somatostatin (SS)   | 生长抑素                    |
| sonic hedgehog  | 音猬因子                    |
| Sonic Hedgehog Protein (Shh)  | 音猬蛋白                    |
| sound-pressure level (SPL)  | 声压级                     |
| spatial summation   | 空间累积                    |
| spectral information  | 频谱信息                    |
| spectrin-fodrin   | 血影蛋白-胞影蛋白               |
| Speech Interpretation & Recognition Interface (Siri)                    | 语音识别接口                  |

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|---|------------|
| spike discriminator                         | 脉冲鉴别器      |
| spike timing-dependent plasticity (STDP)    | 脉冲时序的可塑性   |
| spinal nerves                               | 脊神经        |
| spinal nucleus of the bulbocavernosus (SNB) | 球海绵体肌脊髓核   |
| spinal preparation                          | 脊髓样品       |
| Spinal proprioceptor                        | 脊髓本体感受器    |
| Spinal trigeminal nucleus (STN)             | 三叉神经脊髓核    |
| spinalization                               | 脊髓横切术      |
| spine head                                  | 棘头         |
| spinobulbar muscular atrophy (SBMA)         | 脊髓延髓肌萎缩症   |
| spinocerebellar ataxias (SCAs)              | 脊髓小脑共济失调   |
| splicing                                    | 剪接         |
| sporadic AD                                 | 散发性阿尔茨海默病  |
| Src homology 3 domain (SH3 domain)          | SH3 域      |
| stage N3                                    | 非快速眼动阶段 3  |
| Stanley Cohen                               | 斯坦利·科恩     |
| Stanley Prusiner                            | 史坦利·布鲁希纳   |
| Stanley S. Stevens                          | 史坦利·史蒂文斯   |
| stapedial reflex                            | 镫骨肌反射      |
| stapedius muscle                            | 镫骨肌        |
| starburst amacrine cell                     | 星形无长突细胞    |
| superior temporal gyrus                     | 颞上回        |
| Staufen                                     | 双链核糖核酸结合蛋白 |
| system A transporter (SAT)                  | 系统 A 转运蛋白  |
| Tauists                                     | Tau 信徒     |
| steep function                              | 阶梯函数       |
| step cycle                                  | 步进周期       |
| stellate cell                               | 星形细胞       |
| Sten Grillner                               | 斯滕·格瑞那     |
| Stephen Kuffler                             | 斯蒂芬·库夫勒    |
| Stephen Liberles                            | 斯蒂芬·利伯莱斯   |
| stereotypic                                 | 模式化的       |
| sternocleidomastoid muscle (SCM)            | 胸锁乳突肌      |

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| Steven Keele   | 史蒂文·基尔     |
| Steven Kuffler   | 史蒂文·库夫勒    |
| Steven McCarroll   | 史蒂文·麦卡罗    |
| Steven Waxman  | 史蒂文·韦克斯曼   |
| Steven Wise  | 史蒂文·怀斯     |
| stimulus (S)   | 刺激         |
| stimulus-response (S-R)  | 刺激响应       |
| stomatogastric ganglion (STG)  | 口胃神经节      |
| Stria terminalis   | 终纹         |
| Strauss  | 施特劳斯       |
| striatonigral  | 黑质-纹状体     |
| Striatum (STR)   | 纹状体        |
| Striola  | 弧形微纹       |
| STS-temporalparietal junction  | 颞上沟-颞顶联合区  |
| stylohyoid   | 茎突舌骨肌      |
| subceruleus neuron   | 蓝斑下核       |
| Subfornical organ  | 穹窿下器       |
| sublenticular extended amygdala (SLEA)                               | 近管状延伸杏仁核   |
| subiculum  | 海马下托       |
| subject  | 受试者        |
| Submodality  | 亚模态        |
| subplate (SP)  | 底板         |
| substance P  | P 物质 (肽物质) |
| substantia gelatinosa  | 胶状质        |
| substantia nigra and ventral tegmental area of the midbrain (SN/VTA) | 黑质/中脑腹侧被盖区 |
| substantia nigra pars compacta (SNc, SNpc)                           | 黑质致密部      |
| substantia nigra pars reticulata (SNr)                               | 黑质网状部      |
| substrate protein  | 底物蛋白       |
| subthalamic nucleus (STN)  | 丘脑底核       |
| subthalamonigral   | 丘脑黑质       |
| subtractive inhibition   | 减法抑制       |
| subventricular zone (SVZ)  | 室下区        |

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| sudden unexpected death<br>in epilepsy (SUDEP) | 癫痫突发意外死亡          |
| sudden infant death syndrome (SIDS)            | 婴儿猝死综合症           |
| Sulcus limitans                                | 界沟                |
| Samuel Detwiler                                | 塞缪尔·戴特威勒          |
| Sylvian fissure                                | 外侧裂               |
| subfornical organ (SFO)                        | 穹窿下器              |
| superior cerebellar peduncle (SCP)             | 小脑上脚              |
| Superior cervical ganglion                     | 颈上神经节             |
| superior colliculus (SC)                       | 上丘                |
| superior frontal language area (SFL)           | 额上回语言区            |
| superior longitudinal fasciculus               | 上纵束               |
| superior oblique                               | 上斜肌               |
| Superior orbital fissure                       | 眶上裂               |
| superior rectus                                | 上直肌               |
| superior temporal polysensory area (STP)       | 上颞多感觉区            |
| superior temporal sulcus (STS)                 | 颞上沟               |
| superior view                                  | 俯视图               |
| superficial radial nerves                      | 浅桡神经              |
| superior salivatory nucleus                    | 上涎核               |
| supplementary eye field (SEF)                  | 辅助视区              |
| supplementary motor area (SMA)                 | 辅助运动区             |
| supplementary motor cortex (SMC)               | 辅助运动皮层            |
| Suppressor of<br>cytokine signaling 3 (SOCS3)  | 细胞因子信号通路<br>抑制因子3 |
| supraoptic nucleus (SON)                       | 视上核               |
| survival motor neuron (SMN)                    | 运动神经元生存           |
| Susan Lederman                                 | 苏珊·莱德曼            |
| susceptibility factor                          | 敏感因子              |
| Susumu Tonegawa                                | 利根川进              |
| Sylvian aqueduct                               | 中脑水管              |
| sympathetic nervous system (SNS)               | 交感神经系统            |
| synapsin                                       | 突触素               |
| synaptic boutons                               | 突触扣结              |

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|--|-----------------------------|
| synaptic cleft   | 突触间隙                        |
| synaptic terminal  | 突触末稍                        |
| Synaptobrevin (synaptic vesicle-associated membrane protein, VAMP) | 小突触囊泡蛋白<br>(突触小泡结合性膜蛋白)     |
| synaptogenesis   | 突触形成                        |
| synaptotagmin  | 突触结合蛋白                      |
| synaptotagmin-1 (syt1)   | 突触结合蛋白 1                    |
| syncytium  | 合胞体                         |
| tabes dorsalis   | 脊髓痨                         |
| tabula rasa  | 白板                          |
| Tadashi Isa  | 伊佐正                         |
| Takao Hensch   | 高雄·亨施                       |
| Talairach space  | 塔莱拉什空间                      |
| Talin  | 踝蛋白                         |
| tamping iron   | 铁夯                          |
| Tangier disease  | 丹吉尔病                        |
| target error   | 目标误差                        |
| targetmembrane SNAREs (t-SNAREs)                                   | 靶膜可溶性 N-乙基<br>马来酰亚胺敏感因子附着受体 |
| Taste bud  | 味蕾                          |
| Taste pore   | 味孔                          |
| tdTomato   | 红色荧光蛋白                      |
| Tegretol   | 卡马西平                        |
| tetracycline transactivator (tTA)                                  | 四环素激活因子                     |
| tetracycline-responsive element (Teto, TRE)                        | 四环素响应元件                     |
| tetraethylammonium (TEA)   | 四乙胺                         |
| Telethonin   | 视松蛋白                        |
| television camera (TV Camera)                                      | 电视摄像头                       |
| Temporal operculum   | 颞叶岛盖                        |
| Temporo-parieto-occipital (TPO)                                    | 颞顶枕区                        |
| template matching  | 模板匹配                        |
| temporal pole  | 颞极                          |
| tensor tympani   | 鼓室张肌                        |
| tensor veli palatini   | 腭帆张肌                        |

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| Terje Lømo   | 泰耶·洛莫         |
| terminal arbor   | 末梢分枝          |
| Terminal cisterna  | 终池            |
| tetanus  | 强直刺激          |
| tetrabenazine  | 丁苯那嗪          |
| tetrahydrocannabinol (THC)   | 四氢大麻酚         |
| tetramethylammonium (TMA)  | 四甲胺           |
| tetraspan membrane protein in hair-cell stereocilia (TMHS, LHFPL5) | 毛细胞静纤毛中的四跨膜蛋白 |
| tetrodotoxin (TTX)   | 河豚毒素          |
| the biology of the mind  | 心理生物学         |
| the law of dynamic polarization                                    | 动态极化理论        |
| The Mind of a Mnemonist  | 记忆大师的心灵       |
| The processes of neuron  | 神经元突起         |
| Theodor Schwann  | 西奥多·施旺        |
| theory of mass action  | 整体活动理论        |
| theory of mind   | 心智理论          |
| Thermal nociceptor   | 温度性伤害感受器      |
| thioacetylation  | 硫代酰化          |
| Thomas Albright  | 托马斯·奥尔布赖特     |
| Thomas Bourgeron   | 托马斯·波热龙       |
| Thomas Elliott   | 托马斯·艾略特       |
| Thomas Graham Brown  | 托马斯·格拉汉姆·布朗   |
| Thomas Hunt Morgan   | 托马斯·亨特·摩尔根    |
| Thomas Reese   | 托马斯·里斯        |
| threat conditioning  | 威胁条件反射        |
| threonine (Thr)  | 苏氨酸           |
| threonine-286 (Thr286)   | 苏氨酸-286       |
| three-line bisection task  | 三线平分任务        |
| Thunberg   | 桑伯格           |
| Thymine (T)  | 胸腺嘧啶          |
| Thyrotropin (TSH)  | 促甲状腺激素        |
| Thyrotropin-releasing hormone (TRH)                                | 促甲状腺素释放激素     |

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| tibialis anterior (TIB)                            | 胫前肌       |
| Tidal volume                                       | 潮气量       |
| Tim Bliss  | 帝姆·布利斯    |
| tim gene   | 无节律基因     |
| TIM  | 无节律蛋白     |
| Timothy syndrome                                   | 蒂莫西综合症    |
| Timothy Bliss                                      | 蒂莫西·布利斯   |
| tinnitus   | 耳鸣        |
| Tip link   | 顶连        |
| Titian   | 提香        |
| Thomas Elbert                                      | 托马斯·艾尔伯特  |
| tobramycin   | 妥布霉素      |
| Todd paralysisc                                    | 托德瘫痪      |
| Todd Sacktor                                       | 托德·萨克特    |
| Tonegawa Susumu (Tonegawa)                         | 利根川进      |
| tonic activity                                     | 血管紧张性活动   |
| tonotopic map                                      | 音调拓扑映射    |
| topographic map                                    | 拓扑映射      |
| Torpedo marmorata                                  | 石纹电鳐      |
| Torsten Wiesel                                     | 托斯坦·威泽尔   |
| Tourette syndrome                                  | 图雷特综合症    |
| toxins   | 毒素        |
| trace amine-associated receptors (TAAR)            | 微量胺相关受体   |
| tractography                                       | 纤维束成像     |
| tripitan   | 曲普坦类      |
| transcortical aphasias                             | 经皮层失语症    |
| transcortical motor aphasia                        | 经皮层运动型失语症 |
| Transcranial magnetic stimulation (TMS)            | 经颅磁刺激     |
| transcriptional oscillator                         | 转录振荡      |
| transcription factors                              | 转录因子      |
| transcriptome                                      | 转录组       |
| transcutaneous electrical nerve stimulation (TENS) | 经皮神经电刺激   |
| transducin (T)                                     | 转导蛋白      |

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| transfection   | 转染                        |
| transfer RNA (tRNA)  | 转运核糖核酸                    |
| transforming growth factor (TGF $\beta$ )                      | 转化生长因子 $\beta$            |
| transient receptor potential (TRP)                             | 瞬时受体电位                    |
| transient receptor potential ankyrin (TRPA)                    | 瞬时受体电位锚定蛋白                |
| transient receptor potential melastatin (TRPM)                 | 瞬时受体电位 M 型                |
| transient receptor potential vanilloid (TRPV)                  | 瞬时受体电位香草醛受体               |
| transit amplifying cell  | 过渡放大细胞                    |
| transitional probability                                       | 转移概率                      |
| translational science  | 转化科学                      |
| transmembrane AMPA receptor regulatory proteins (TARP)         | 跨膜 AMPA 受体调控蛋白            |
| transmembrane channel-like proteins 1 and 2 (TMC1/2)           | 跨膜离子通道样蛋白 1/2             |
| transmembrane inner-ear-expressed gene (TMIE)                  | 跨膜内耳表达基因                  |
| transmitter  | 递质                        |
| Transneuronal degeneration                                     | 跨神经元变性                    |
| transthyretin  | 甲状腺素视黄质运载蛋白               |
| transverse temporal gyri (Heschl's gyrus)                      | 颞横回                       |
| transverse tubules   | 横小管                       |
| trans-(1S,3R)-1-amino-1,3-cyclopentanedicarboxylic acid (ACPD) | 反-(1S,3R)-1-氨基-1,3-环戊烷二羧酸 |
| trapezoid body   | 斜方体                       |
| trapezoid nuclei   | 斜方体核                      |
| trigeminal motor nucleus                                       | 三叉神经运动核                   |
| trigeminal nerve   | 三叉神经                      |
| Trigger zone   | 触发区                       |
| triplet repeat diseases  | 三核苷酸重复疾病                  |
| tyrosine kinase (Trk)  | 酪氨酸激酶                     |
| trisynaptic pathway  | 三突触通路                     |

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|---|----------------------|
| trochlear nucleus                               | 滑车神经核                |
| trochlear nerve (trochlear)                     | 滑车神经                 |
| Troponin  | 肌钙蛋白                 |
| true negative (TN)                              | 真负                   |
| True positive (TP)                              | 真正                   |
| true-positive rate (TPR)                        | 真阳性率                 |
| tryptophan (Trp)                                | 色氨酸                  |
| tuberomammillary nucleus (TMN)                  | 结节乳头核                |
| tuberous sclerosis complex (TSC)                | 结节性硬化症               |
| tubulin   | 微管蛋白                 |
| Tufted cell                                     | 簇状细胞                 |
| tumor necrosis factor (TNF)                     | 肿瘤坏死因子               |
| tuning curve                                    | 调谐曲线                 |
| Turk-Browne                                     | 图尔克·布朗               |
| turret region                                   | 炮塔区域                 |
| TWIK—Related K <sup>+</sup> Channel 1 (TREK-1)  | 弱内向整流相关的钾离子通道 1      |
| Two-pore-domain potassium channel (K2P)         | 双孔 K <sup>+</sup> 通道 |
| type 5 metabotropic glutamate receptor (mGluR5) | 代谢 5 型谷氨酸受体          |
| tyrosine (Tyr)                                  | 酪氨酸                  |
| tyrosine kinases (trk)                          | 酪氨酸激酶                |
| ubiquitin                                       | 泛素                   |
| Ubiquitin hydrolase                             | 泛蛋白水解酶               |
| ubiquitin ligase                                | 泛素连接酶                |
| ulnar nerves                                    | 尺神经                  |
| ulnar-radial                                    | 尺侧-桡侧                |
| uncinate fasciculus                             | 钩状束                  |
| unconditioned response (UR)                     | 非条件反射                |
| unconditioned stimulus (US)                     | 非条件刺激                |
| uncoupling protein-1 (UCP1)                     | 解偶联蛋白 1              |
| unilateral neglect                              | 单侧忽视                 |
| unipolar brush cell                             | 单极刷状细胞               |
| Uridine (U)                                     | 尿苷                   |
| US Food and Drug Administration (FDA)           | 美国食品和药物管理局           |

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|---|------------------|
| Usher syndrome  | 遗传性耳聋-色素性视网膜炎综合症 |
| utilization behavior  | 使用性行为            |
| utricle   | 椭圆囊              |
| Uwe Frey  | 尤韦·弗雷            |
| V1  | 初级视觉皮层           |
| V2  | 二级视觉皮层           |
| V3  | 三级视觉皮层           |
| V4  | 四级视觉皮层           |
| vacuolar-type H <sup>+</sup> -ATPase (V-ATPase)                         | 空泡型氢离子三磷酸腺苷转运酶   |
| vagus nerves  | 迷走神经             |
| Valium  | 地西泮              |
| valproic acid   | 丙戊酸              |
| vascular organ of the lamina terminalis (OVLT)                          | 终板血管器官           |
| vasoactive intestinal peptide (VIP)                                     | 血管活性肠肽           |
| vasopressin (VAS)   | 加压素              |
| Vasopressin receptor 2 (V2R)  | 血管加压素受体 2        |
| vasopressin receptors (V1a)   | 血管加压素受体          |
| velocardiofacial syndrome (VCFS)  | 腭心面综合症           |
| ventral caudate (vCD)   | 腹侧尾核             |
| ventral lateral aspect of the ventromedial hypothalamic nucleus (vlVMH) | 下丘脑腹内侧核的腹侧侧面     |
| ventral intraparietal area (VIP)  | 顶内沟腹侧区           |
| Ventral Nucleus of the Trapezoid Body(MNTB)                             | 斜方体腹侧核           |
| ventral pallidum (VP)   | 腹侧苍白球            |
| ventral posterior lateral (VPL)   | 腹后外侧             |
| ventral posterior lateral nucleus                                       | 腹后外侧核            |
| ventral posterior medial (VPM)  | 腹后内侧             |
| Ventral posterior medial nucleus of thalamus                            | 丘脑腹后核            |
| ventral posterior superior (VPS)  | 腹后上              |
| ventral premammillary nucleus (PMV)                                     | 腹侧乳头体核           |
| ventral premotor cortex (PMv)   | 腹侧前运动皮层          |
| ventral spinocerebellar tract (VSCT)                                    | 腹侧脊髓小脑束神经元       |

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|---|-------------------------|
| ventral subparaventricular zone (vSPZ)  | 腹侧脑室下区                  |
| ventral tegmental area (VTA)  | 腹侧被盖区                   |
| ventricular zone (VZ)   | 脑室区                     |
| ventrolateral component of the ventromedial hypothalamus (VMHvl)                            | 下丘脑腹内侧的腹外侧部分            |
| ventrolateral funiculus (VLF)   | 腹外侧索                    |
| ventrolateral group   | 腹外侧核群                   |
| ventrolateral prefrontal cortex (VLPFC, F47)  | 腹外侧前额叶皮层                |
| ventrolateral preoptic neuron   | 腹外侧视前神经元                |
| ventrolateral preoptic nuclei (VLPO, VLPFC, F47)  | 腹外侧视前核                  |
| Ventrolateral thalamus  | 丘脑腹外侧核                  |
| ventromedial hypothalamus (VMH)   | 腹内侧下丘脑                  |
| Verbal Behavior   | 《语言行为》                  |
| vergence movement   | 聚散运动                    |
| Vernier task  | 装游标的任务                  |
| Vernon Mountcastle  | 弗农·芒卡斯尔                 |
| version movement  | 同向运动                    |
| vertical limb of the diagonal band (DBv)  | 斜角带垂直支                  |
| vertical meridian   | 垂直经线                    |
| vesicular ACh transporter (VACHT)   | 囊泡乙酰胆碱转运蛋白              |
| Vesicular GABA Transporter (VGAT)   | 囊泡 $\gamma$ -氨基丁酸转运体    |
| vesicular glutamate transporter (V-GluT, VGlut)   | 囊泡谷氨酸转运蛋白               |
| vesicular glutamate transporter 2 (VGLUT2)  | 囊泡谷氨酸转运蛋白 2 型           |
| vesicular monoamine transporter (VMAT2)   | 囊泡单胺转运蛋白                |
| vesicular soluble N-ethylmaleimide-sensitive factor attachment protein receptors (v-SNAREs) | 囊泡可溶性 N-乙基马来酰亚胺敏感因子附着受体 |
| vestibular caloric test   | 前庭冷热试验                  |
| vestibular nuclei   | 前庭核                     |
| vestibulospinal tracts (VST)  | 前庭脊髓束                   |
| vestibulo-ocular reflexes (VOR)   | 前庭-眼动反射                 |
| Victor Horsley  | 维克多·霍斯利                 |

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| Victoria Abraira                                     | 维多利亚·阿布雷拉                |
| viewpoint invariance                                 | 视角不变性                    |
| Viktor Gurfinkel                                     | 维克多·古芬克尔                 |
| Viktor Hamburger                                     | 维克多·汉堡                   |
| Vinculin   | 纽带蛋白                     |
| virilization   | 男性化                      |
| visual cue   | 视觉提示                     |
| visual discrimination                                | 视觉辨别                     |
| visual experience                                    | 视觉经验                     |
| visual primitives                                    | 视觉元素                     |
| visual posterior sylvian area (VPS)                  | 视后外侧裂                    |
| visual receptive field (vRF)                         | 视觉感受野                    |
| visuomovement neuron                                 | 视觉运动神经元                  |
| visuotopic map                                       | 视觉拓扑映射                   |
| volitional movement                                  | 意向性运动                    |
| Voltage-clamp  | 电压钳                      |
| voltage-gated Ca <sup>2+</sup> channels (VGCCs, Cav) | 电压门控 Ca <sup>2+</sup> 通道 |
| voltage-gated potassium channels (Kv)                | 电压门控 K <sup>+</sup> 通道   |
| volume transmission                                  | 容积传递                     |
| voluntary movement                                   | 自主运动                     |
| Vomeronasal organ (VNO)                              | 犁鼻器                      |
| vomiting   | 呕吐                       |
| von Economo  | 冯·伊克诺莫                   |
| Wade Marshall  | 韦德·马歇尔                   |
| wake-promoting neuron                                | 觉醒促进神经元                  |
| Walker   | 沃克                       |
| Wallerian degeneration                               | 华勒氏变性                    |
| Wallerian degeneration slow (Wlds)                   | 华勒氏慢变性                   |
| Walter B. Cannon                                     | 沃尔特·坎农                   |
| Walter Cannon  | 沃尔特·坎农                   |
| Walter Gaskell                                       | 沃尔特·盖斯凯尔                 |
| Walter Hess  | 沃尔特·赫斯                   |
| Walter Nernst  | 沃尔特·能斯特                  |

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| Weber   | 韦伯                 |
| Weigert stain   | 威格特染色              |
| Wernicke-Geschwind model                                    | 韦尼克·格施温德模型         |
| Wernicke's aphasia  | 韦尼克失语症             |
| what/Who pathway/stream                                     | 内容通路               |
| where pathway   | 空间通路               |
| where/how pathway/stream                                    | 空间通路               |
| Wilder Penfield   | 怀尔德·潘菲尔德           |
| wild-type   | 野生型                |
| Wilhelm Erb   | 威廉·尔勃              |
| Wilhelm Sommer  | 威廉·索默              |
| Wilhelm Wundt   | 威廉·冯特              |
| William Bayliss   | 威廉·贝利斯             |
| William Cramer  | 威廉·克莱姆             |
| William de Kooning  | 威廉·德·库宁            |
| William James   | 威廉·詹姆斯             |
| William Newsome   | 威廉·纽瑟姆             |
| Williams syndrome   | 威廉综合症              |
| William Willis  | 威廉·威利斯             |
| Wilson Tanner   | 威尔逊·泰纳             |
| Windsor side chair  | 温莎侧椅               |
| Winrich Freiwald  | 温里奇·弗赖瓦尔德          |
| wiring diagram  | 连线图                |
| Wisconsin general test apparatus (WGTA)                     | 威斯康辛通用测验仪          |
| wingless-type MMTV integration site family (Wnt)            | 无翅型乳腺瘤病毒整合位点家族     |
| wingless-type MMTV integration site family, member 1 (Wnt1) | 无翅型乳腺瘤病毒整合位点家族成员 1 |
| withdrawal reflex   | 缩回反射               |
| Wolffian duct   | 中肾管                |
| Wolfgang Köhler   | 沃尔夫冈·苛勒            |
| Wolfram Schultz   | 沃尔夫勒姆·舒尔茨          |
| Woolsey   | 伍尔西                |
| Wylie Vale  | 怀利·瓦莱              |
| Xenopus   | 非洲爪蛙               |

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|-------------------------------------|--------------|
| Xenopus frog                        | 爪蟾           |
| X-linked recessive                  | X 连锁隐性       |
| Yasushi Miyashita                   | 宫下靖          |
| Ying-hui Fu                         | 傅颖慧          |
| Yngve Zotterman                     | 左特曼          |
| Zarontin                            | 乙琥胺          |
| Zinc finger 9                       | 锌指 9         |
| zinc finger protein                 | 锌指蛋白         |
| zona limitans intrathalamica (ZLI)  | 限制性间脑区       |
| $\beta$ -actin                      | 肌动蛋白         |
| $\beta$ -endorphin ( $\beta$ -END)  | $\beta$ -内啡肽 |
| $\beta$ -lipotropin ( $\beta$ -LPH) | $\beta$ -促脂素 |
| $\gamma$ -secretase                 | $\gamma$ 分泌酶 |

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