InfoOrbit

Los desafíos de un viaje espacial de larga duración

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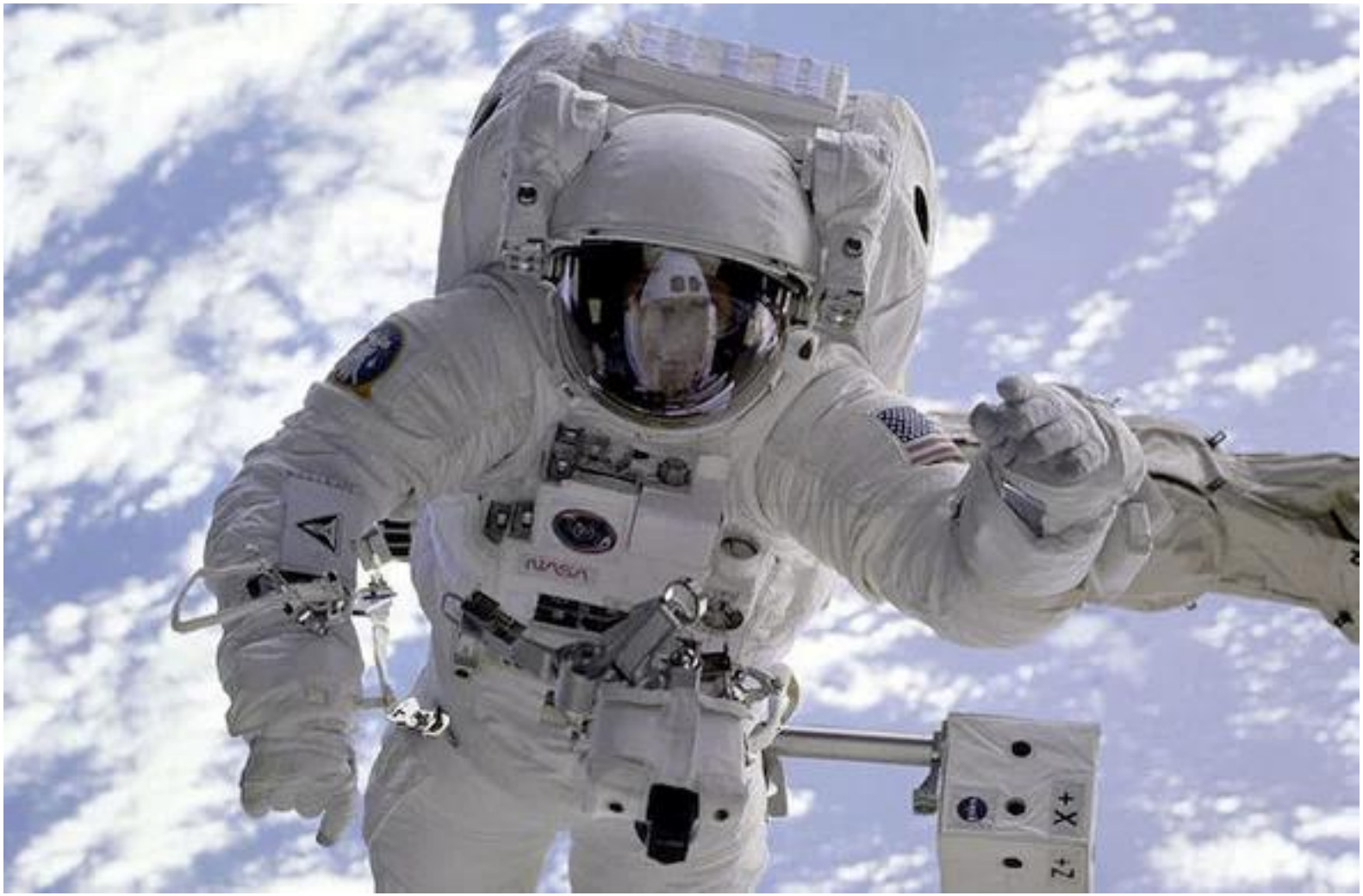
Firts Lego League – 27 noviembre 2018

Impacto sobre la salud mental y el cerebro



Proyecto de simulación-SFINCSS-99

SFINCSS-99

SIMULATION OF FLIGHT OF INTERNATIONAL CREW ON SPACE STATION
ИМИТАЦИЯ ПОЛЕТА МЕЖДУНАРОДНОГО ЭКИПАЖА НА КОСМИЧЕСКОЙ СТАНЦИИ

Проводился ИМБП совместно с NASDA (Японское космическое агентство), ESA (Европейское космической агентство), CSA (канадское космическое агентство), несколькими университетами США.

Основной экипаж – 240 суток

Первый экипаж посещения – 110 суток

Третий экипаж посещения– 110 суток

Proyecto de simulación-SFINCSS-99

Primary Crews	Days	Chamber	Number, Gender, Age	Nationality	Profession	Remarks
Group-1 Mir schedule	240	EU-100 (100 m^3)	4 males 37-48 years	Russian	3 physicians, 1 engineer	Group-1 performed scheduled operations during eight working hours maximum with the energy expenditure of 2400-2600 kcal. They lived on a schedule typical for space station Mir crews. Physical exercise adhered to the Mir protocol i.e. a four-day cycle.
Group-2 ISS assembly phase: Fixed work-rest schedule	110	EU-37 (200 m^3) Mars Flyer module	4 males 27-45 years	1 German (Commander), 3 Russians	3 physicians, 1 engineer	Group-2 entered EU-37 on day 28 since the beginning of the experiment and remained until day 138 (total: 110 days). The crew had a *fixed* work-rest schedule and was charged with more demanding and tedious tasks that cost daily average of 3200 up to 3600 kcal. The increased energy expenditure was associated with mimicking the ISS assembly operations. This was achieved via an EVA simulator, and exercise machines. The working day was up to 12 hours.
Group-3 ISS assembly phase: Flexible work-rest schedule	110	EU-37 (200 m^3) Mars Flyer module	3 males, 1 female 27-37 years	Japan, Austria, Russia and Canada	3 physicians, 1 sports expert	Group-3 began in EU-37 22 days after the return of group-2, and remained in the module for 110 days. The crew faced the same challenges and difficulties as its predecessor, but with a *flexible* work-rest schedule.

Proyecto de simulación-SFINCSS-99

Aviat Space Environ Med. 2004 Jul;75(7 Suppl):C44-51.

Culture and tension during an international space station simulation: results from SFINCSS '99.

Sandal GM.

RESULTS:
Compared with Group 1, Group 3 evaluated their own group and the Mission Control more negatively. A conflict between Group 1 and 3 was reflected in mutual negative ratings after 1 mo. This situation resulted in an unplanned closure of the hatch between the chambers and in one subject leaving the study prematurely. Group 3 expressed dissatisfaction with mission support and interventions from outside personnel to resolve the interpersonal problems. The entrance of an international visiting crew was reported to alleviate tension between Groups 1 and 3. Language problems and different attitudes toward gender relations were factors identified as having a major impact on the inter-group relationship.

Proyecto de simulación-Marte 520d

OPEN ACCESS Freely available online

PLOS | ONE

Psychological and Behavioral Changes during Confinement in a 520-Day Simulated Interplanetary Mission to Mars

Mathias Basner[1]*, David F. Dinges[1], Daniel J. Mollicone[2], Igor Savelev[3,4], Adrian J. Ecker[1], Adrian Di Antonio[1], Christopher W. Jones[1], Eric C. Hyder[1], Kevin Kan[2], Boris V. Morukov[5], Jeffrey P. Sutton[4,6]

Proyecto de simulación-Marte 520d

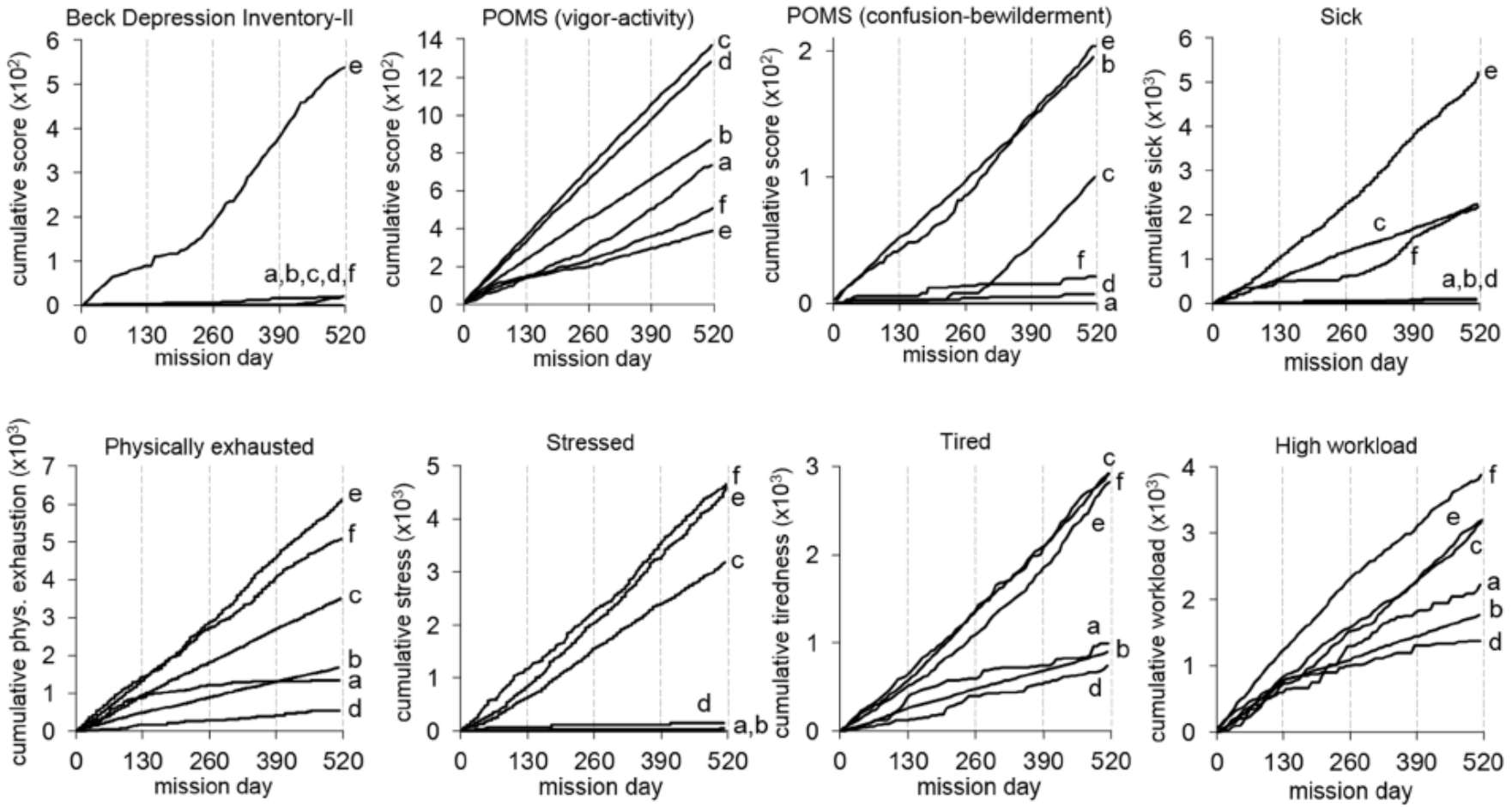


Figure 1. Cumulative self report scores show differential reactions to confinement. Cumulative scores are plotted for each crewmember (identified by lower case letters *a–f*) relative to time in mission for the 8 self-report measures that showed significant differences between crewmembers (see Table 2). Beck-Depression Inventory-II and Profile of Mood States Short Form (POMS) scores were not transformed to a range from 0 to 100 for this figure.

PLoS One - 2014

Proyecto de simulación-Marte 520d

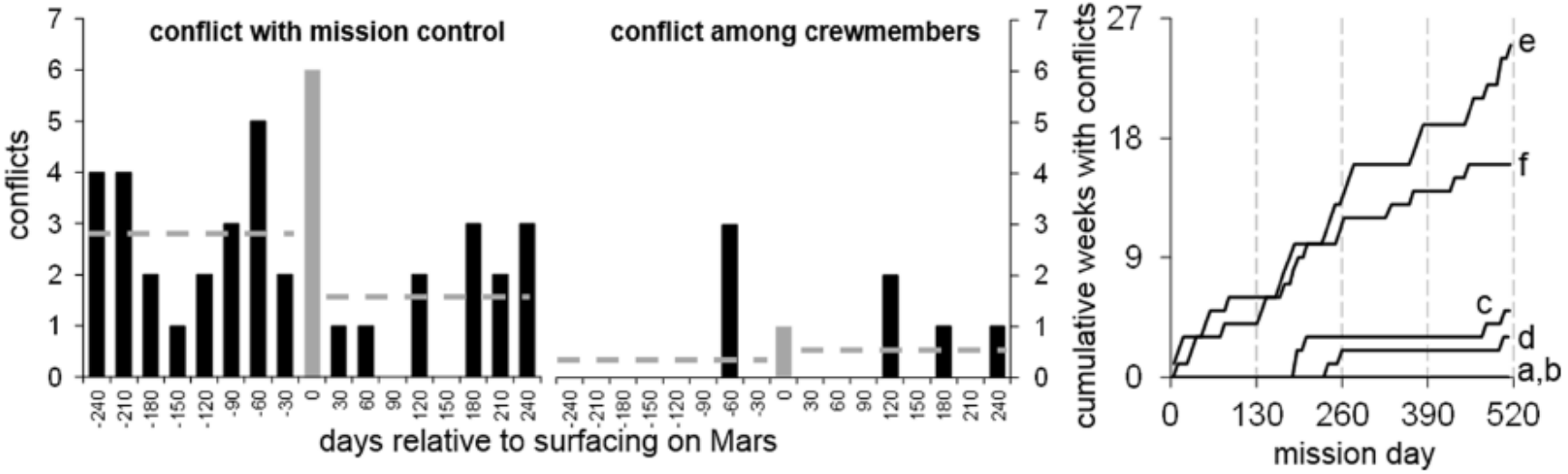


Figure 2. Perceived conflicts throughout the simulated Mars mission. The number of conflicts with mission control (left panel) and other crewmembers (middle panel) were counted for 30-day periods relative to a 30-day period surrounding the landing on Mars between mission days 244 and 273. One conflict was counted if the crewmember recorded either a current conflict and/or a conflict in the past seven days. Conflicts (reported once weekly) with mission control peaked during the Mars landing period, were lower in the second half compared to the first half of the mission (dashed lines represent averages over pre- and post-landing periods), and were reported more often than conflicts among crewmembers. The right panel shows the cumulative number of weeks with conflicts relative to time in mission by crewmember. The majority of conflicts were reported by crewmembers *e* and *f*.
doi:10.1371/journal.pone.0093298.g002

PLoS One - 2014

Efecto de la microgravedad sobre el sistema nervioso

Orbital and Intracranial Effects of Microgravity: Findings at 3-T MR Imaging[1]

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Radiology: Volume 263: Number 3—June 2012 ▪ *radiology.rsna.org*

Duración corta < 30 días

Duración larga > 30 días

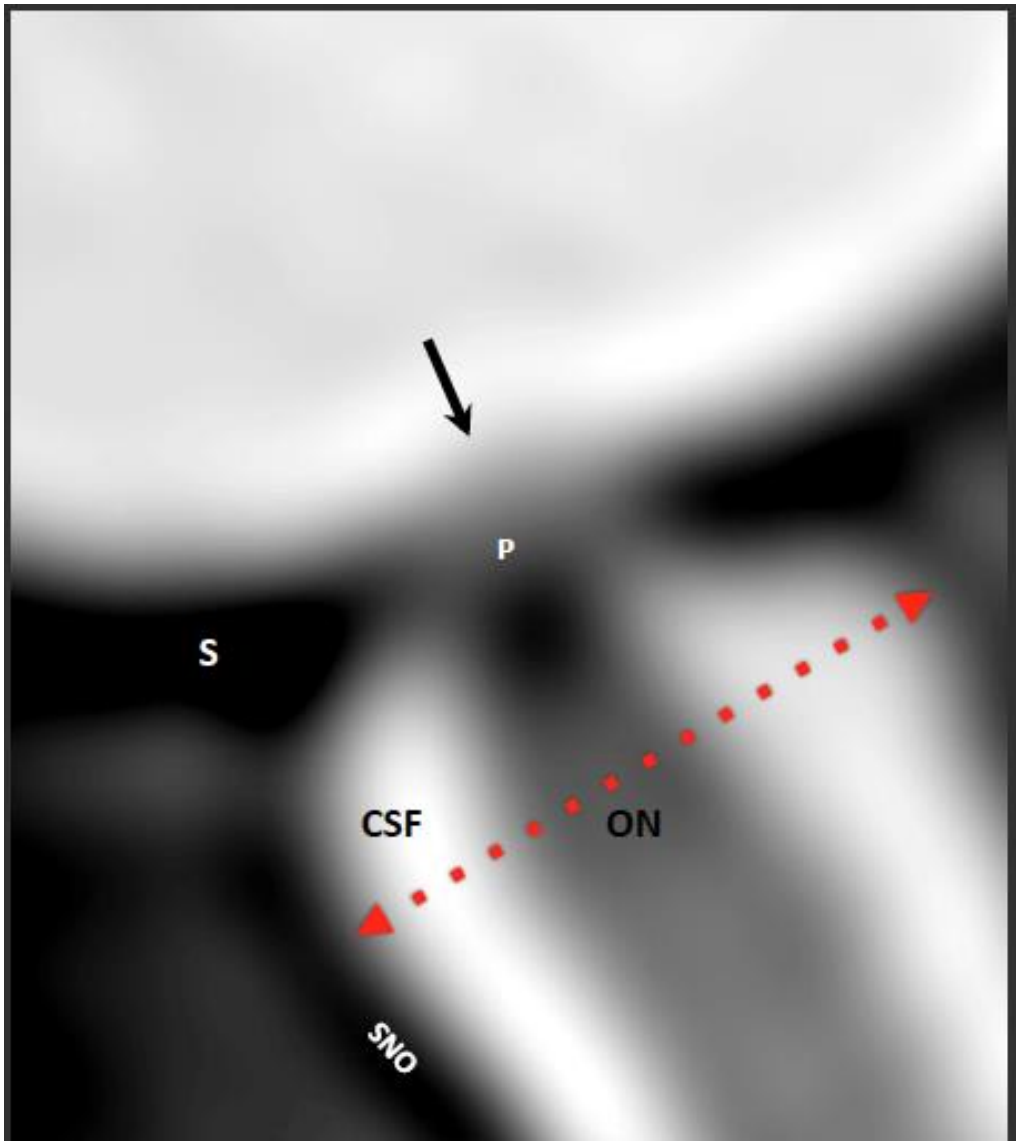
Problemas oculares tras periodos en el espacio de larga duración

Cumulative Lifetime Exposure to Microgravity (days)	Total Number of Astronauts	Posterior Globe Flattening	Optic Nerve Sheath Kink	Optic Disc Protrusion	ONSD≥ 5.9mm	Moderate or greater Pituitary Concavity
<30 (short)	12	1(4%)	1(4%)	0	5(19%)	0
≧30 (long)	15	6(22%)	3(11%)	4(15%)	9(33%)	3(11%)

Efectos de la microgravedad sobre la estructura del ojo, nervio óptico y pituitaria (en base a MRI)

- Optic nerve sheath distension
- Optic disc edema
- Posterior Globe Flattening
- Tortuosity of the optic nerve sheath
- Moderate Concavity of the pituitary gland with posterior displacement of the stalk

Problemas: Edema y distensión de la vaina del nervio óptico



OPTIC DISC EDEMA: Optic disc edema is a non-specific imaging finding. It is the cardinal sign of idiopathic intracranial hypertension when associated with intracranial hypertension. Note protrusion of the optic papilla (p) (black arrow) with loss of the physiologic cup and distension of the ONS (red arrow) on this astronaut with long duration microgravity exposure . S = Sclera; CSF = subarachoid space surrounding the optic nerve; ON = optic nerve; ONS = optic nerve sheath.

Problemas oculares en astronautas

- Globo ocular aplanado posteriormente
- Nervio óptico tortuoso

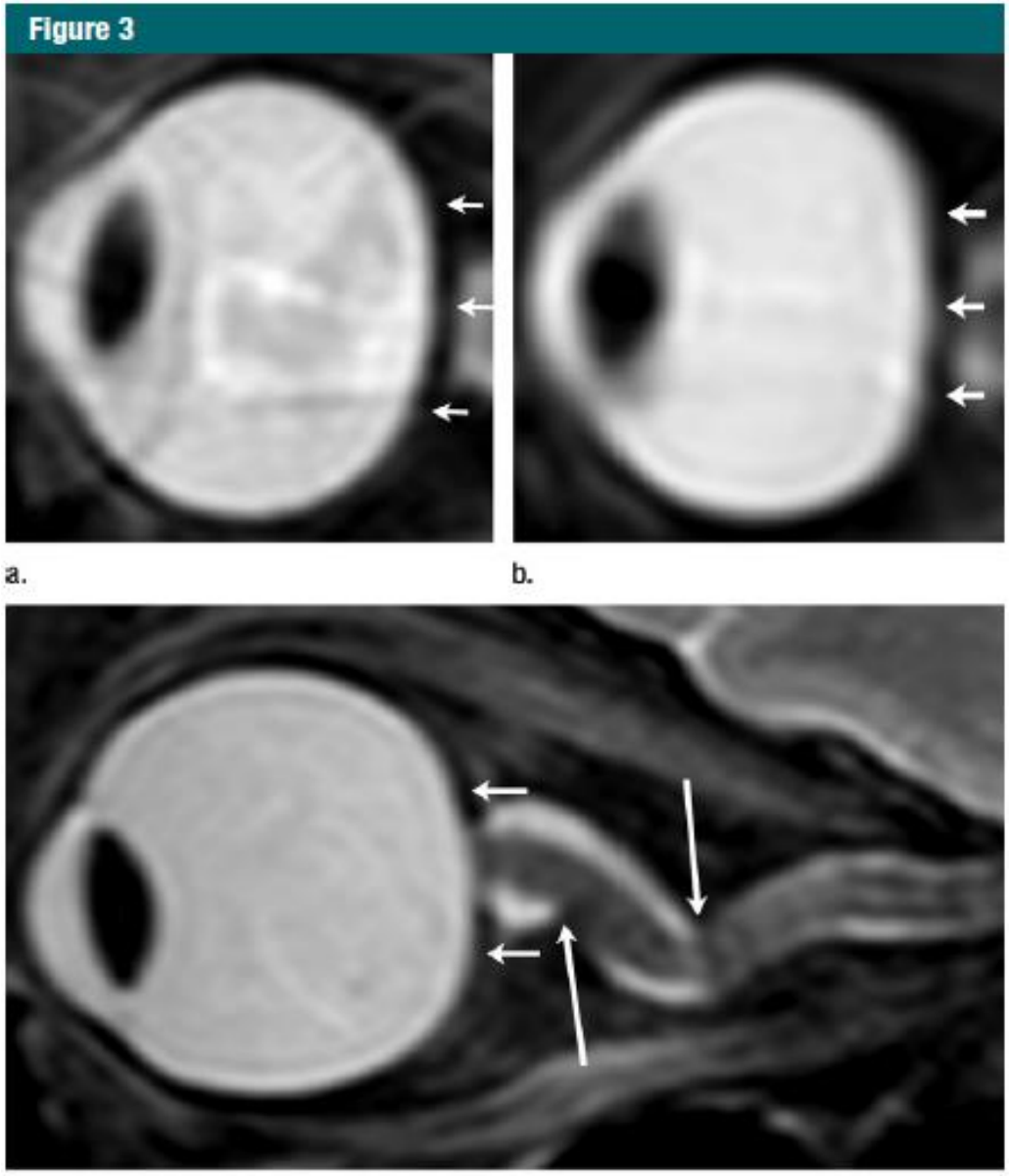


Figure 3: Sagittal oblique T2-weighted MR images. **(a)** Image of left eye before long-term exposure to microgravity. Note convexity of posterior globe (arrows). **(b)** Image of left eye after long-term exposure to microgravity. Note loss of convexity of the posterior scleral margin (arrows). **(c)** Image of right eye of different astronaut. Note two abruptly angulated foci (long arrows) in optic nerve sheath and posterior globe flattening (short arrows).

Efectos de la microgravedad sobre la estructura del cerebro

Se analizaron 10 cosmonautas (edad media 44 años; duración de la misión espacial 189 días)

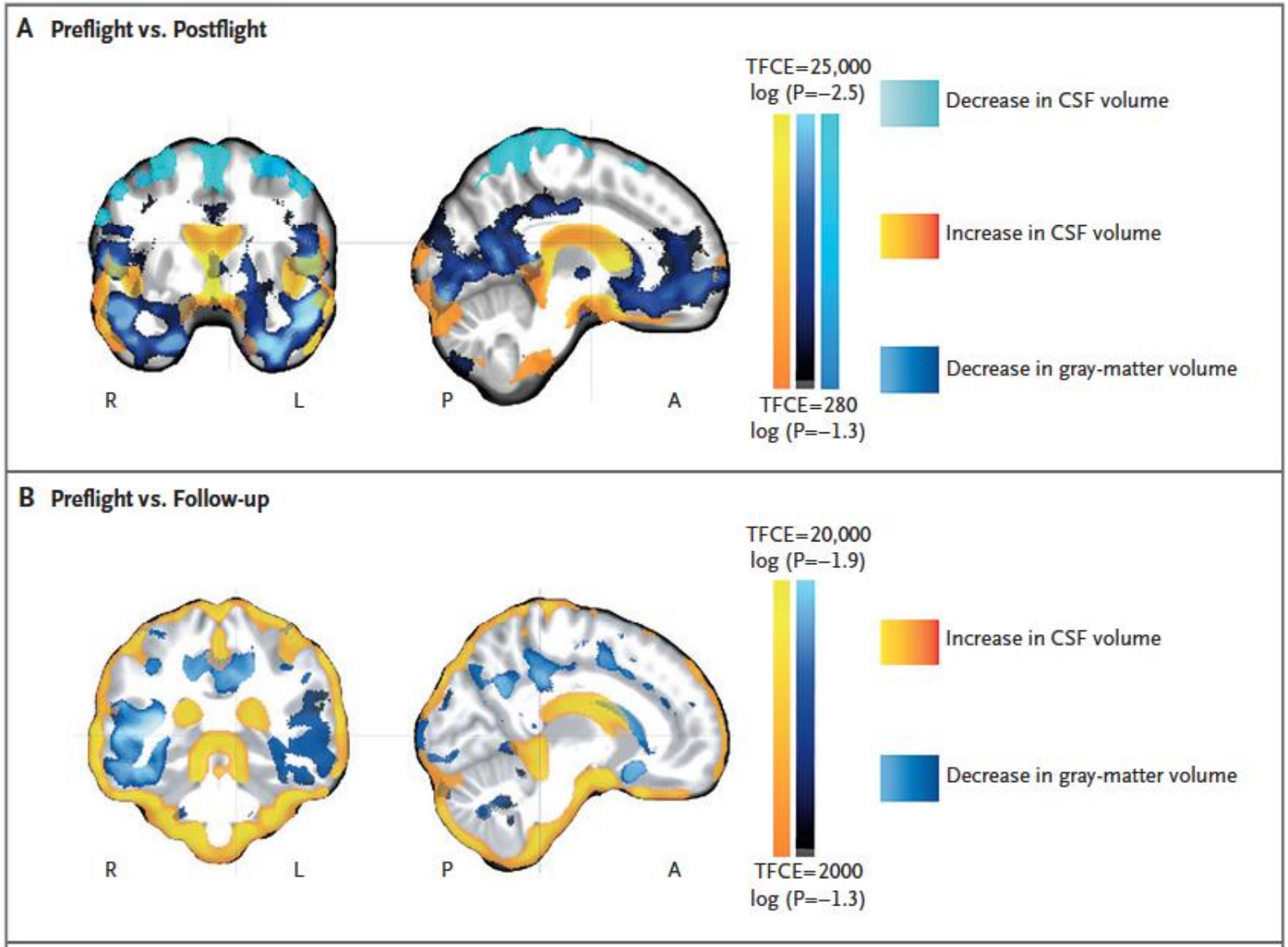
Se realizó MRI en tres momentos:

- antes del viaje
- poco después de regresar (9 días)
- varios meses después de regresar (a los 209 días, de media)

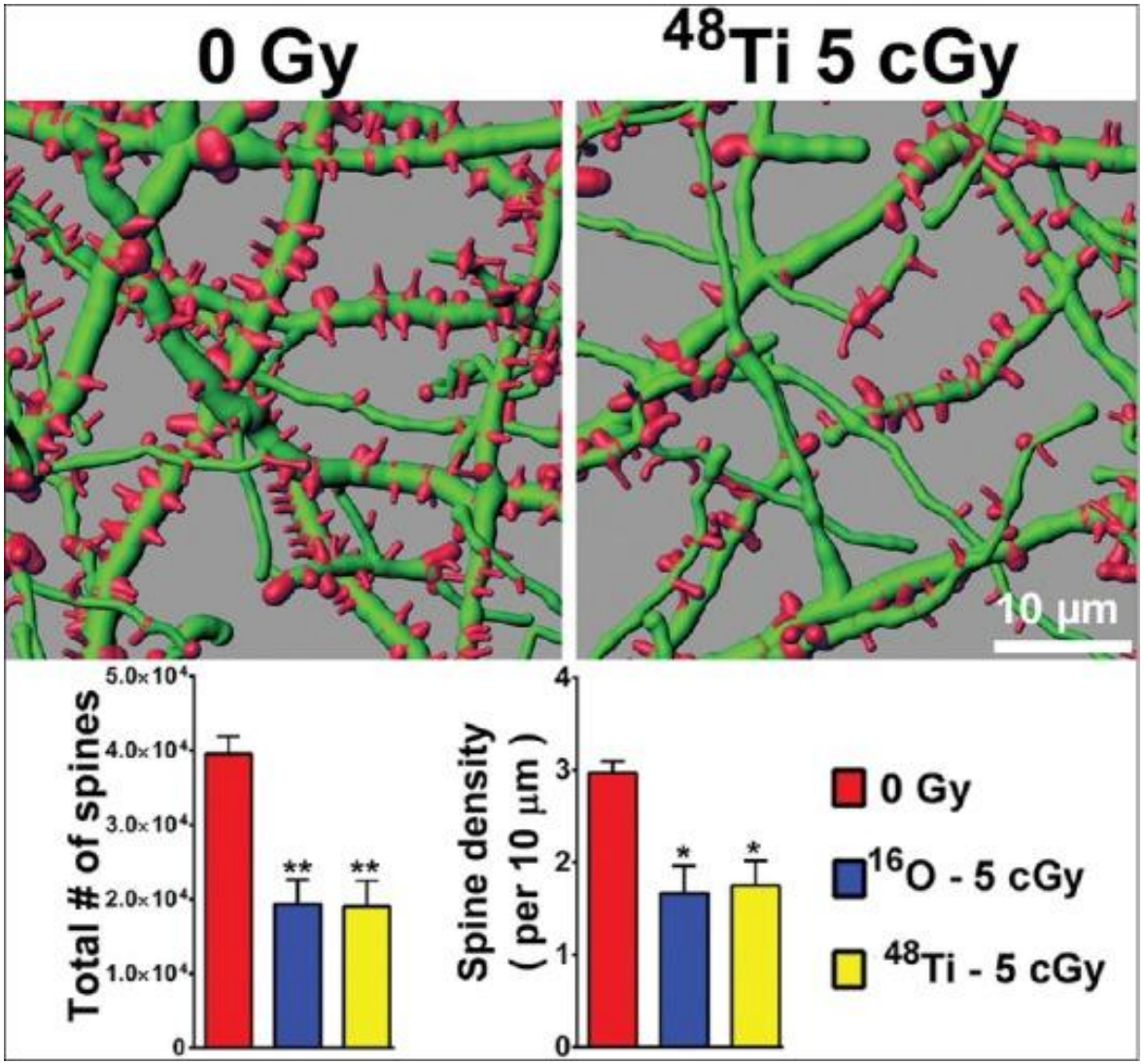
The NEW ENGLAND JOURNAL of MEDICINE OCTOBER 25, 2018

Brain Tissue–Volume Changes in Cosmonauts

Aumento de líquido intracraneal y reducción persistente en áreas del cerebro



Efecto de la radiación cósmica en el cerebro



Surg Neurol Int. 2018; 9: 9.

Space–brain: The negative effects of space exposure on the central nervous system

Rahul Jandial, Reid Hoshide, J. Dawn Waters, and Charles L. Limoli

No hay suficientes datos sobre cómo afecta el aislamiento y la microgravedad a las mujeres

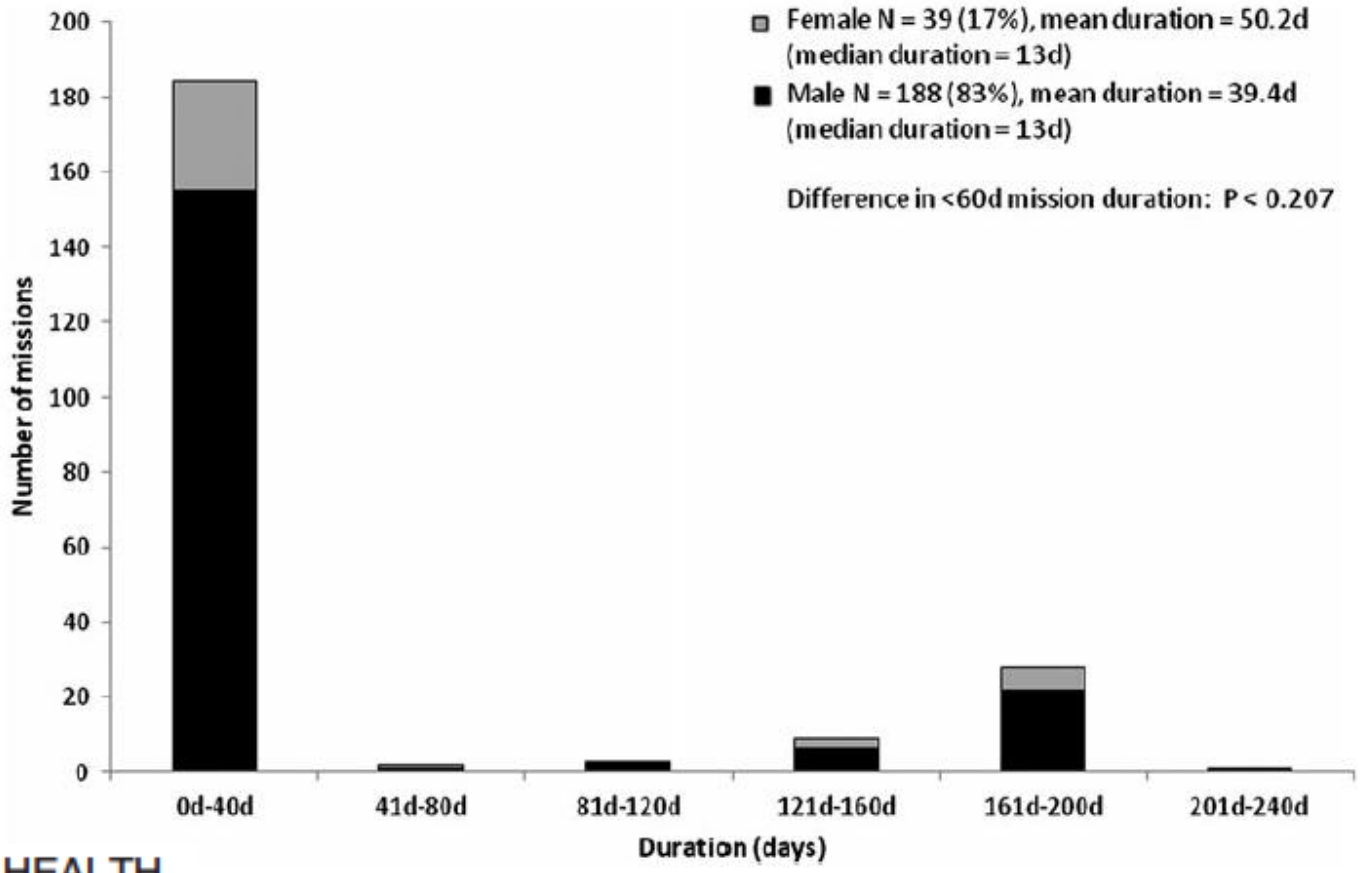


FIG. 1. Space mission duration distribution for U.S. astronauts (1998–2013).

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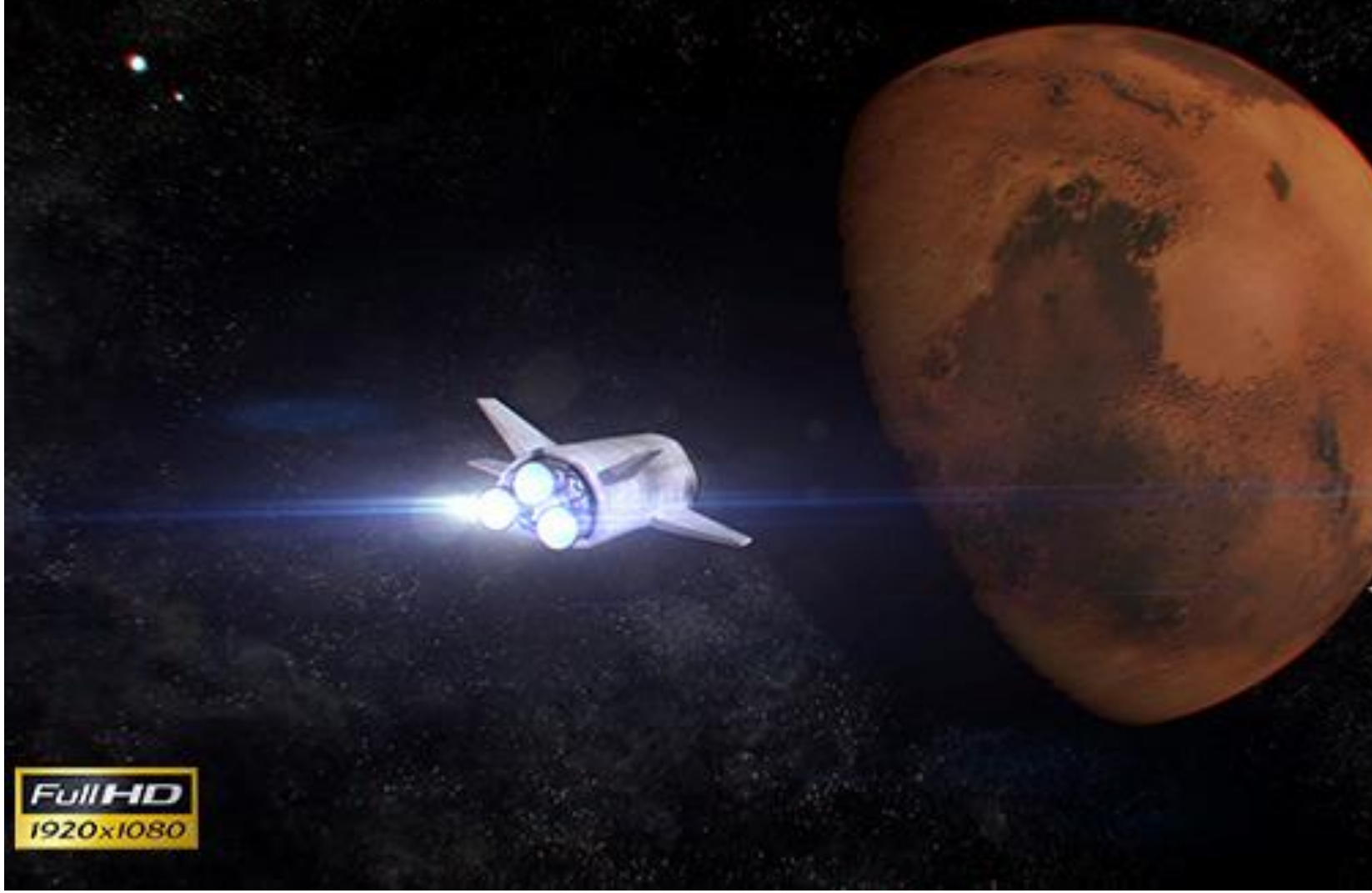
Desafíos de los viajes espaciales de larga duración

- Problemas de estrés, insomnio, depresión
- Conflictos y bajo rendimiento derivados de lo anterior
- Problemas visuales y alteraciones cerebrales derivados de la microgravedad y la radiación
- Problemas de convivencia en tripulaciones mixtas
- Cuestiones relacionadas con la reproducción en el espacio sin riesgo para el desarrollo pre- and postnatal



Moltes gràcies! ¡Muchas gracias! Thank you very much!