

Virtual meeting, real and sound science: report of the 17th Meeting of the Spanish Society for Developmental Biology (SEBD-2020)

Virtual Meeting. 18th to 20th November 2020.

Sofia J. Araújo^{*1,2}, Isabel Almudi³, Laura Bozal-Basterra⁴, Fernando Casares³, Sergio Casas-Tintó⁵, Augusto Escalante⁶, Fernando García-Moreno^{7,8}, María Losada-Pérez⁵, Ignacio Maeso³, Luciano Marcon³, Oscar H. Ocaña⁹, Olatz Pampliega⁷, Álvaro Rada-Iglesias¹⁰, Teresa Rayon¹¹, James Sharpe^{12,13,14}, James D. Sutherland⁴, Cristina Villa del Campo⁹ and Rosa Barrio^{*4}

¹Department of Genetics, Microbiology and Statistics, and Institute of Biomedicine (IBUB), School of Biology, University of Barcelona, Barcelona, Spain, ²Institute of Biomedicine, University of Barcelona (IBUB), Barcelona, Spain, ³The CABD (CSIC-UPO-JA), Seville, Spain, ⁴Center for Cooperative Research in Biosciences (CIC bioGUNE), Basque Research and Technology Alliance (BRTA), Bizkaia Technology Park, Derio, Spain, ⁵Molecular, Cellular and Developmental Neurobiology Department, Instituto Cajal-CSIC, Madrid, Spain, ⁶Institute of Neurosciences, CSIC-Universidad Miguel Hernández, Campus de San Juan, Alicante, Spain, ⁷Achucarro Basque Center for Neuroscience, Scientific Park of the University of the Basque Country (UPV/EHU), Leioa, Spain and Department of Neuroscience, Faculty of Medicine and Nursing, UPV/EHU, Leioa, Bizkaia, Spain, ⁸KERBASQUE Foundation, Bilbao, Spain, ⁹Centro Nacional de Investigaciones Cardiovasculares Carlos III, Madrid, Spain, ¹⁰Institute of Biomedicine and Biotechnology of Cantabria (IBBTEC), CSIC-University of Cantabria-Sociedad para el Desarrollo de Cantabria, Santander, Spain, ¹¹The Francis Crick Institute, London, UK, ¹²European Molecular Biology Laboratory (EMBL) Barcelona, Barcelona, Spain, ¹³Centre for Genomic Regulation (CRG), Barcelona Institute of Science and Technology (BIST), Barcelona, Spain and ¹⁴Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain.

PREAMBLE The Spanish Society for Developmental Biology (SEBD) organized its 17th meeting in November 2020 (herein referred to as SEBD2020). This meeting, originally programmed to take place in the city of Bilbao, was forced onto an online format due to the SARS-CoV2, COVID-19 pandemic. Although, we missed the live personal interactions and missed out on the Bilbao social scene, we were able to meet online to present our work and discuss our latest results. An overview of the activities that took place around the meeting, the different scientific sessions and the speakers involved are presented here. The pros and cons of virtual meetings are discussed.

KEY WORDS: *Developmental Biology, virtual meeting, Spanish Society for Developmental Biology, SEBD, scientific society, meeting, preprint, growth, self-organization, neurodevelopment, genome, Cell Biology, disease, evo-devo*

Introduction

From the 18th to the 20th of November 2020, the Spanish community of developmental biologists sat by their computers and was given a golden opportunity to taste the newest research being carried out in Spain and abroad. The meeting, organized by CIC bioGUNE, the University of the Basque Country and the University

of Cantabria, gathered about 280 registrants and received 132 scientific abstracts. Participants ranged from undergraduate to senior researchers, with a broad participation of Ph.D. students (Fig. 1). Despite the cold online format, this was a warm meeting with highly interactive discussions and different online platforms which enabled sharing scientific results and face-to-face social-breaks. Sessions and extra activities of the meeting were maintained as initially planned. All invited speakers accepted to transit to the virtual format, so the program could preserve its initial essence.

Outreach activities in schools: what is developmental biology and why is it important?

Along with our annual SEBD meetings, we have been creating opportunities for public engagement with Developmental Biology (Araújo, 2018). This year, due to the online format, we were not able to invite people into our conference space, but we had the advantage of taking the meeting virtually to many schools around Spain. We organized teams of 3 scientists, that virtually opened their laboratories to schools in the rural areas of Madrid, la Rioja or Alicante. We introduced them to what developmental biology is, explaining that all the animals including humans originate from one

Abbreviations used in this paper: SEBD, Spanish Society for Developmental Biology.

***Address correspondence to:** Sofia J. Araújo. Department of Genetics, Microbiology and Statistics, and Institute of Biomedicine (IBUB), School of Biology, University of Barcelona, Diagonal 643, 08028 Barcelona, Spain. E-mail: sofiajaraujo@ub.edu -  <https://orcid.org/0000-0002-4749-8913>
Rosa Barrio. Center for Cooperative Research in Biosciences (CIC bioGUNE), Basque Research and Technology Alliance (BRTA), Bizkaia Technology Park, Building 801A, 48160 Derio, Spain. E-mail: rbarrio@cicbiogune.es -  <https://orcid.org/0000-0002-9663-0669>

Submitted: 22 January 2021; Accepted: 22 January, 2021; Published online: 22 January 2021.

ISSN: Online 1696-3547, Print 0214-6282

© 2021 UPV/EHU Press (Bilbao, Spain) and Creative Commons CC-BY. This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/>), which permits you to Share (copy and redistribute the material in any medium or format) and Adapt (remix, transform, and build upon the material for any purpose, even commercially), providing you give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. Printed in Spain.

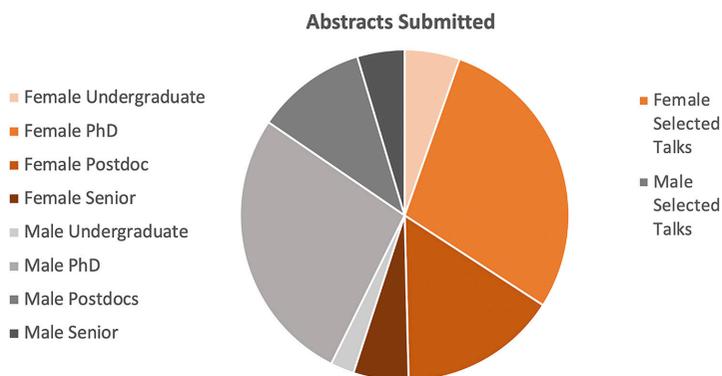


Fig. 1. Proportion of abstracts received according to gender and career stage. The meeting gathered about 280 registrants and received 132 Abstracts. It included 9 invited oral presentations (6 females), 16 short presentations selected from Abstracts (10 females), 31 Flash Talk presentations (13 females) and 115 poster presentations. Registrants ranged from undergraduate to senior researchers, with a broad participation of Ph.D. students.

cell that divides many times and undergoes development to form an adult being. Different groups took with them a variety of photos and laboratory objects, from live imaging of embryos to photos of microscopes. Overall, all groups reported the events being really interactive. The students were delighted, showing a genuine curiosity and asking a lot of questions. Not only they enjoyed the virtual visit to the labs but also meeting real scientists. In one school we were told that the scientific discussions continued at the school yard even after the session had long finished.

Workshop on animal experimentation: how to survive an animal ethics evaluation

During the early morning of the first day, Augusto Escalante organized a workshop on animal experimentation. The aim of this workshop was to discuss the tips and tricks around an evaluation by an ethics committee. The workshop, conducted in Spanish, focused on Spanish law and documentation. We had the great opportunity to listen to Alberto Pastor, founder and director of the Responsible Research Office at the University Miguel Hernández (Elche, Spain), as our lead-speaker. He walked us through the complete process of designing, writing, submitting and evaluating of a proposal for animal experimentation. He highlighted common pitfalls made by researchers when addressing questions from the ethics committee and recommended the best databases to use in documenting and defending the proposed methods. In the second part of the workshop, Victoria Fornés, data scientist at the Responsible Research Office, focused on the statistical analysis required to provide solid grounds to the research proposal. She recommended tools and strategies to follow in order to correctly estimate animal group sizes and expected results, an essential part of the evaluation if we aim to apply thoroughly the three Rs in the ethical use of animal experimentation: Reduce, Reuse and Recycle. Finally, Alberto Pastor gave us several clues regarding the upcoming new regulations in the Spanish law on animal experimentation. The new law will require researchers to renovate their certifications through confirmable continuous education on animal experimentation, which was one of the purposes of this workshop. We would like to encourage other scientific societies in Spain to provide these opportunities for their meeting participants.

Independent peer review and refereed preprints – the good, the bad and “the” publishing: a round table discussion at SEBD2020

Peer review is one of the main pillars on which modern science is based. It ensures a rigorous review of the scientific work by

experts in the field. In addition, it is highly respected by authors as it provides feedback on their work. Peer review and journal publishing have been historically linked to one another. In fact, peer review is considered a step necessary for the final publication in a journal. Recently, the publishing ecosystem has been revolutionized with the emergence of non-peer reviewed manuscripts called preprints. This allows for a disconnection between peer review and journals, which has challenged some of the assumptions on the benefits of peer review (Fig. 2). This workshop at SEBD2020 covered the strategies of some innovative projects that have arisen as a response to the changing landscape in the peer review and publishing systems. These projects have started offering feedback, commentary and journal-independent peer review.

One of the major disadvantages that scientists find in preprints is their lack of peer review and commenting (Fig. 2). PREreview and Peer Community In (PCI) are two initiatives that have developed new strategies to give feedback to preprints. PREreview is a platform where the whole scientific community can review preprints. PCI supports researchers reviewing and recommending preprints in their field. As long as this community of reviewers/recommenders is inclusive and well accepted, PCI offers a new peer review system where there is no need for publication in classic journals.

Traditional publishing is also testing transformative reviewing alternatives. Review Commons is an initiative that disconnects peer review from journals, thus allowing a fair review prior to a specific submission. One of the partners of the Review Commons initiative is Company of Biologists. Despite being a traditional journal, Company of Biologists are keen to try new methods of peer review, and have extensively embraced preprints with their preLights project. Not intended to be a substitute for peer-review, preLights recommends preprints and has improved the visibility and commenting of selected preprints.

The eLife ethos is to improve research communication through open science. To that end, they have transformed the traditional peer review system when they launched their journal by including an open dialogue between reviewers and editors to ensure a fair and unique strategy for the revision of submitted manuscripts. In their futuristic view of a scientific peer review system without journals, eLife aims to substitute the traditional publication system and act as a journal that curates and reviews preprints.

The general feeling of the discussion about these initiatives was excitement about the possibilities of changing the peer review system that has been held traditionally in the hands of but a few. However, concerns about the validity of the review without the label of the signing publisher were raised, although other participants

also argued that the same concerns can be raised in the case of publishers, especially in the case of journals in which the review process is not very transparent (Fig. 2). It is undeniable that peer review systems outside of traditional journals have come to stay. Therefore, it is worth discussing and deciding which ones are more valuable for the community.

Opening lecture

The scientific sessions of the meeting kicked off with a plenary talk by Maria Leptin (EMBL and EMBO director) on how cell mechanics can modulate intrinsic genetic programmes. Maria is a reference in the fields of gastrulation and cell migration (Fig. 3). To our meeting she brought her recent work on how external mechanical stimuli can determine cellular behaviour (Bhide *et al.*, 2020). Using the epithelial folding event that constitutes the beginning of gastrulation in *Drosophila*, she described how genetically identical cells can either constrict or stretch, depending on tissue-wide interactions. Based on experimental observations and simulations in which cells behave as ductile materials with non-linear mechanical properties, she discussed how this behaviour is a general emergent property of actomyosin networks in a supracellular context. Overall, a great virtual opening lecture, with a lively follow-up discussion.

Growth and scaling

The development of biological structures, from cells to organisms, is constrained by their size. This is why the first scientific session dwelled in the relationships between growth and scaling, a session sponsored by Developmental Dynamics. It started with a talk by Marian Ros, from the Institute of Biomedicine and Biotechnology of Cantabria (IBBTEC), on her most recent work in collaboration with Denis Duboule's research group (Fernandez-Guerrero *et al.*, 2020). Space and time regulation of *Hox* genes has been an outstanding question in development. Marian discussed how *Hoxc* genes are activated in a colinear manner in the embryonic limb ectoderm and are subsequently transcribed, unravelling the importance of this cluster in providing the level of HOXC proteins necessary for the proper growth and scaling of hairs and nails (Fig. 3).

Marian's talk was followed by two of abstract-

selected talks. The first one, by Jesus Lopez-Gay, from the Curie Institute, described how epithelial cells subjected to morphogenetic forces use their stress fibres to limit their extension, by making the number of stress fibers scale with the cell's surface (López-Gay *et al.*, 2020). This was followed by a talk by Maria Rosselló, from the University of Barcelona, in which she described a connection between the Hippo growth regulation pathway and the mitochondria during the process of regeneration of a normal-sized body. After those, we had the pleasure of listening to four 3-minute flash-talks: Maria Almuedo-Castillo (CABD, Seville) on YAP regulation of the cytoskeleton during axis elongation; Giovanni Dalmaso (EMBL Barcelona) on 4D reconstruction of the growing mouse limb; Carlos Martín-Blanco (CABD, Seville) on the control of growth and regeneration in *Cloeon dipterum's* gills; and Morena Raiola (CNIC Madrid) on 4D quantitative analysis of mouse heart tube morphogenesis. All these talks and the poster communications within this session pointed to interesting systems to investigate the slippery relationship between growth and morphology.

Self-organization

The second session focused on multicellular self-organization, a subject that had not been included in previous editions of this meeting. This topic is gaining attention in developmental biology

Peer review: **friend** or **foe** to the community?

PROS	CONS
- Rigorous review of peer work	- Slows down the publication process
- Valuable feedback to authors	- Journals use reviewers of confidence: Potential biases
- Accepted in the scientific community	- Reviewers decide the "fate" of the paper: Power to few

Participants: Teresa Alonso, Sofia Araujo, Katherine Brown, Michael Eisen.

Fig. 2. The workshop on journal independent peer-review. Advantages and disadvantages of peer review in the publishing system (top) and the panel during the discussion with the participants (bottom).

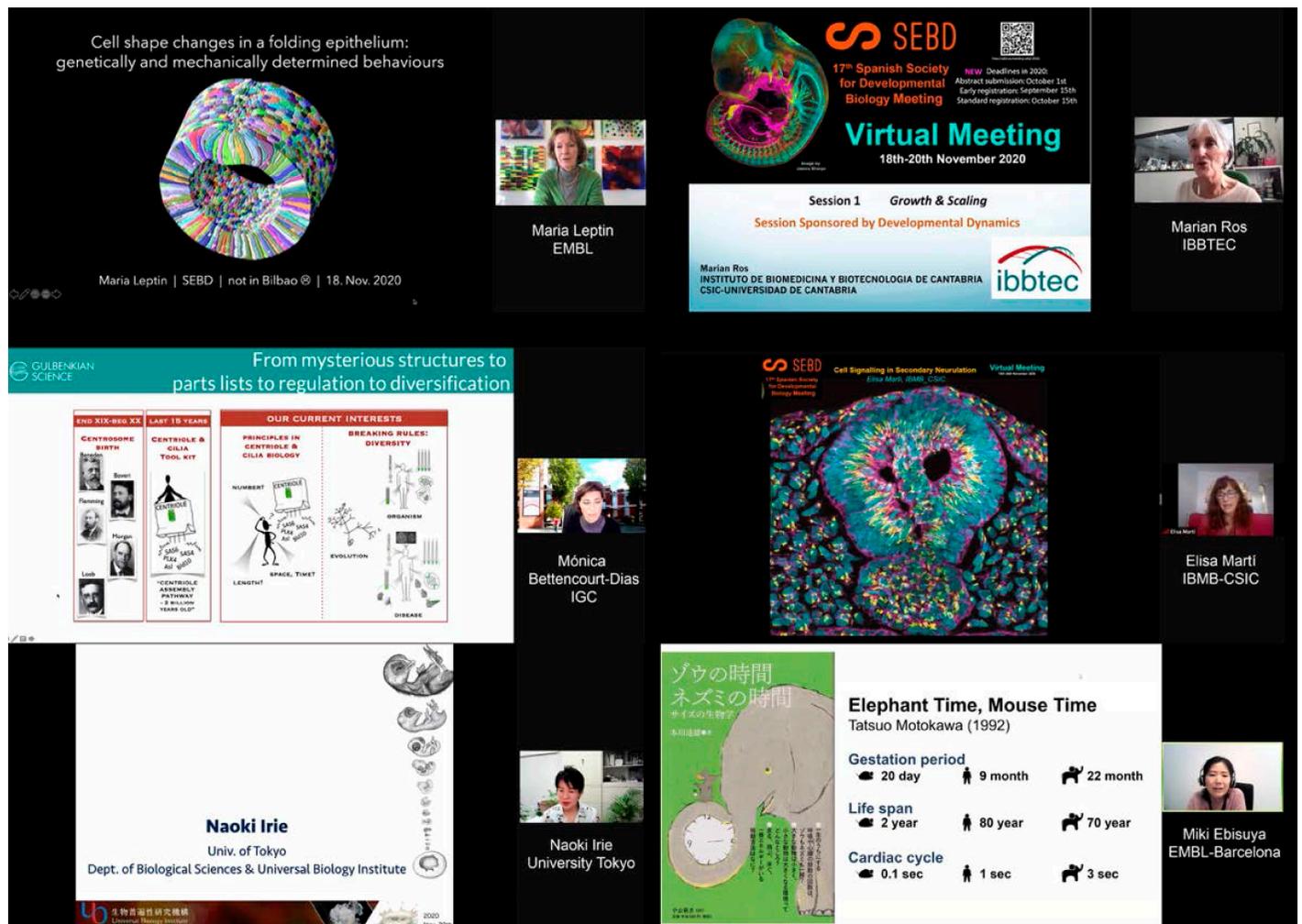


Fig. 3. An overview of some of the invited speakers seminars.

due to the increasing evidence that multicellular systems can form tissues and organs in an autonomous manner. This has been highlighted particularly by three-dimensional cultures of stem cells, that can self-organize to form structures that mimic the shape and function of tissues and organs *in vitro*. The first talk by Miki Ebisuya (EMBL, Barcelona) presented recently published work and showed an elegant example of how mouse ES cells and human iPS cells can autonomously generate oscillating expression patterns of HES7 that mimic the somitogenesis clock of the embryo (Matsuda *et al.*, 2020). These oscillations are faster in mouse ES cells than in human iPS cells, reflecting the species specific somitogenesis clock period observed in the embryo. As a final outlook, Miki discussed her current projects to extend the study to a larger "zoo" of stem cell systems to investigate how the somitogenesis clock scales in differently sized animals such as pig, bovine or elephant (Fig. 3). The abstract-selected talk by Nora Papai (IMBA, Austria) presented unpublished work to identify conditions that stimulate the robust self-organization of human pluripotent stem cells into organoids that can be used to study interaction between epicardium and cardiac tissue. The following selected talk by Carmen María Gordillo Vázquez (IBiS, Sevilla) dealt with the quantification of natural variation in three-dimensional organization observed in epithelial tissue. The session was concluded with four flash-talks touching

different aspect of multicellular organization. The first presented a theoretical exploration of self-organizing principle with a multicellular simulator developed by Pablo Japón (CABD, Sevilla). Antonio Tagua (IBiS, Sevilla) presented the second one and showed a novel characterization of changes in epithelial packing associated with cell-proliferation during sea urchin and starfish development. The third talk by Irene Delgado (CNIC, Madrid) was on the role of Meis genes in limb initiation and A-P patterning in mouse. The session was concluded by Jelena Raspopovic (CABD, Sevilla) on the scaling properties of self-organizing anterior-posterior patterning in mouse embryoid bodies.

Neurodevelopment

The second day of the meeting started with the third session, focused on the development of the nervous system. The invited talk was given by Elisa Martí (Institut de Biologia Molecular de Barcelona, CSIC, Spain) who told us how the caudal part of the spinal cord is generated through secondary neurulation dependent on cell intercalation driven by SMAD3 and YAP (Gonzalez-Gobart *et al.*, 2020). Elisa fascinated the audience with the fact that, at the junction of the two developmentally different spinal cords, several luminal ventricles emerge and fuse to give rise to the single ependym (Fig. 3). This was followed by two selected talks from the

submitted abstracts. The first one by Teresa Rayon (The Francis Crick Institute, UK), who showed her state-of-the-art research on the tempo of embryonic development and how this varies from one species to another (Rayon *et al.*, 2020). After checking mRNA levels and stability, she argued that the developmental tempo appears to be controlled by protein stability and cell cycle duration. The second talk was presented by Cristina Gil Sanz (Universidad de Valencia, Spain) on the genetic profile of cortical radial glial cells that regulate their mitotic behavior (Fabra-Beser *et al.*, 2020). Cristina presented how a subset of radial glial cells, influenced by high levels of the transcription factor SOX9, behaves different to the rest of radial glial cells. As a result, these progenitors delay their neurogenesis and generate a discrete and differential neuronal lineage in the mouse neocortex.

The session continued with four flash talks selected from the abstract pool by Daniel del Toro (Universidad de Barcelona) on Teneurin-Latrophilin interaction in neuronal guidance (del Toro *et al.*, 2020); Ismael Hernández Núñez (CIBUS, Universidad Santiago de Compostela) on neurogenesis in adult shark retina, Carlos Sánchez-Huertas (Instituto de Neurociencias, Alicante) on +TIP Navigator-1 in growth cone motility (Sánchez-Huertas *et al.*, 2020) and Patricia Jarabo (Instituto Cajal, CSIC) on how IMPL2 modulates neuronal development.

Genomes: a tribute to José Luis Gómez-Skarmeta

On September 16th, the scientific community was shocked by the passing of José Luis Gómez Skarmeta, a worldwide reference in developmental genomics and one of the greatest scientists in Spain, and above all, a dear friend and mentor to a whole generation of scientists. José Luis had a unique talent to look at genomes through the lens of developmental biology. His pioneering work has been instrumental to reveal how the complex regulation of developmental processes profoundly affects the way in which genomes are organized, and how this interplay is essential to understand evolution and disease. Thus, the SEBD2020 Genomes session honoured the memory of José Luis, with outstanding scientific contributions that included many of the topics he investigated throughout his life.

We had the privilege to open the session with Tatjana Sauka-Splenger (University of Oxford, Weatherall Institute of Molecular Medicine). Tatjana is a leading expert on gene regulatory networks and her lab uses different vertebrate model systems such as zebrafish, chick and lamprey to understand how these genomic developmental programmes are modified in evolution and disease. Her talk focused on the regulation of *FoxD3*, a gene encoding a key transcription factor during neural crest development. By studying different *FoxD3* cis-regulatory elements and using single-cell approaches in zebrafish, her work showed the role of *FoxD3* in controlling the development of trunk neural crest cells from neurosodermal progenitors (Lukoseviciute *et al.*, 2018).

This was followed by two selected talks. Tomás Pachano (Center for Molecular Medicine Cologne, University of Cologne) presented his work on the role of orphan CpG islands as determinants of enhancer-gene compatibility. Using a genetic engineering approach, he showed that orphan CpG islands boost the regulatory activity of enhancers by increasing the physical communication with their target genes (Pachano *et al.*, 2020). Francisca Martínez Real (Max Planck Institute for Molecular Genetics) talked about how gene regulatory changes caused by genomic rearrangements

can contribute to morphological evolution. Her work using comparative genomics and 3D-chromatin interaction data identified mole-specific modifications in the regulatory landscapes of the *FGF9* and *CYP17A1* genes that are responsible for the intersexual phenotypes and ovotestes that are characteristic of the females of this iconic mammalian lineage (M. Real *et al.*, 2020).

Finally, the four flash talks by Lorena Buono (Andalusian Centre for Developmental Biology), Jose M. Santos-Pereira (Andalusian Centre for Developmental Biology), Sandra Acosta (Institut de Biologia Evolutiva, CSIC-Universitat Pompeu Fabra) and Tore Bleckwehl (Center for Molecular Medicine Cologne, University of Cologne). In their talks, they discussed gene network bifurcation between the neural retina and retinal pigmented epithelium during optic cup morphogenesis (Buono *et al.*, 2020), the role of CTCF controlling chromatin organization during development using a zebrafish knockout model (Franke *et al.*, 2020), tissue-specific functions of intronic enhancers (Borsari *et al.*, 2020), and the importance of H3K4me1, and enhancer priming for germline competence (Bleckwehl *et al.*, 2020), respectively.

The session ended with a moving tribute video in the memory José Luis Gómez Skarmeta done by several of his many friends, mentees and collaborators, which was also broadcasted to the general public outside the SEBD meeting.

Cell biology

After the lunch break, the session on Cell Biology took place, sponsored by Mechanisms of Development, which covered a broad spectrum of subjects and species with a group of high-quality talks.

The invited lecture by Mónica Bettencourt-Dias (IGC, Portugal) dealt with the *de novo* origin of centrioles, which occurs in certain cell types and whose mechanisms are poorly understood. Using *Drosophila melanogaster*, her laboratory showed that *Plk4* concentration and pericentriolar material factors determine the spatial and temporal kinetics of centriole assembly (Nabais *et al.*, 2020). Mónica tackled the diversity of centriole structure between species and within the same organism, illustrated through the biogenesis of the bicentriole, a peculiar centriole in mosses sperm. The second part of the talk focused on the centriole abnormalities in cancer, where centrosome aberrations are widespread and associated with bad prognosis (Dias Louro *et al.*, 2020).

The plenary talk was followed by two selected talks. Esteban Hoijman (CRG, Barcelona) explained how embryos cope with apoptotic cells before professional phagocyte differentiation. Using quantitative live imaging and transcriptome analysis of zebrafish and mouse embryos together with mathematical modelling, Hoijman showed that epithelial cells function as phagocytes by forming a new type of extended actin-rich protrusion that propel apoptotic fragments at high speed and across large distances in the embryo. The next talk of this session was by Diana Guallar (CIMUS, Santiago de Compostela), who explained how transdifferentiation of somatic cells to pluripotent cells (somatic cell reprogramming) requires RNA modification, a type of transcriptional reprogramming (Guallar *et al.*, 2020).

Right after, the flash talks, selected from the abstracts, were broadcasted. First, Delia Ricolo (University of Barcelona) described how microtubules and actin act in a coordinated way through the action of spectraplakins to regulate lumen formation and branching (Ricolo and Araújo, 2020). Next Carlos Estella (CBMSO-CSIC, Madrid) talked about how cell proliferation and apoptosis are co-

ordinated after DNA damage. Sergio Navarro Cartagena (UMH, Alicante) described that in *Arabidopsis* VCC is required for leaf bilateral symmetry in *Arabidopsis*. Finally, Ana Elena Gaspar (IRB Barcelona) described the non-apoptotic roles of caspases in cell migration.

Bridging the gap between development and disease

Late afternoon, the 6th session on Development & Disease was held, with the privilege of being sponsored by Developmental Biology. The session opened with an inspiring and outstanding talk presented by Ramón Muñoz-Chápuli (University of Málaga), who introduced the audience to the origin and role of endothelial cells in mammals. He highlighted that endothelial cells are present exclusively in vertebrates and are key in their evolution. Ramón then listed specific roles from endothelial cells in multiple processes, such as coelomic epithelia as a heart precursor, the haemangioblast as a source of blood cells or endothelial angiogenesis as critical for the expansion of somatic territories in vertebrates. Overall, he provided a very thorough review of the endothelium's role in vertebrate evolution and development.

Among the abstracts allocated to this session, two of them were selected for oral presentations. Khalil Kass Youssef (Neuroscience Institute of Alicante) described how the process of epithelial to mesenchymal transition (EMT) is plastic and fluid, with cells transitioning through several intermediate stages of EMT. Single cell transcriptomics data of cancer cells from breast tumors identified the conserved transcription factor network for EMT which encodes for different stemness, plasticity and invasion. This knowledge provides insight into the pathogenicity of cancer cells, by which those tumours presenting partial EMT are related with a worse prognosis.

The third talk, by Tamara González Costa (CNIC, Madrid), focused on the role of USP8 in cardiac homeostasis and its relevance in heart development and disease. By performing quantitative proteome analysis, she identified differentially expressed proteins among normal and myocardium devoid of USP8 expression. Tamara suggested that USP8 is required in myocardial cells during development to regulate mitochondrial function and metabolism, an essential process in myocardial maturation.

The four selected flash talks were given by Carlos Camacho de la Macorra (CBMSO-CSIC, Madrid), on actomyosin ring regulating epiboly in zebrafish; Raquel Romero Bueno (CABD, Sevilla), focusing on the role of nuclear envelope proteins in chromatin organization; Ines Marques on the role of Wt1 regulation of cardiomyocyte differentiation and Endika Haro (IBBTEC, Cantabria), on Lmx1b modulation in the limb.

Overall, the session span across a wide range of topics relating to development and disease in different model organisms, providing valuable insights into the molecular mechanisms responsible for pathogenicity.

Evo-Devo

The last day of SEBD2020 started with a plenary session about evolutionary-developmental biology, or EvoDevo. Naoki Irie (University of Tokyo) spoke about the limits that the genetic programs of development impose to the evolution of vertebrates. With an astounding collection of embryos from a plethora of chordate species, Naoki presented a comparison of transcriptomes (Hu *et al.*, 2017) and epigenetic signatures (Uesaka *et al.*, 2018) throughout embryonic development and vertebrate species. Through state-

of-the-art bioinformatics analyses, he showed that vertebrate embryos present a stage of development where most features tend to be highly conserved. Naoki argued that this conservation limited the diversity of body plans after the Cambrian explosion. Regarding the mechanism of this conservation, his data pointed to the pleiotropy of the genes expressed during organogenesis as the main tightening belt of phylum diversity (Fig. 3).

The session continued with with two abstract-selected oral presentations. Paula Miramón (Sars International Centre for Marine Molecular Biology, Norway), told us about her single cell and reporter analyses on the cnidarian *Nematostella vectensis*, which suggest the presence of an adult stem cell population that give rise to somatic and germinal lineages in the adult. Next, Thomas Spruce (CRG, Barcelona) talked about the MBNL family of RNA binding proteins, and the evolution of MBNL3 in placental mammals. This protein has evolved new capabilities that involve the regulation of placenta growth, probably due to the location of MBNL3 on the mammalian X-chromosome. Finally, we had the opportunity of listening to the selected flash talks by Martin Estermann (Monash University, Australia), Irepan Salvador-Martinez (UCL, London) and Cristian Cañestro (University of Barcelona), which explained their work on single cell transcriptomics in chicken, a new tool to visualise cell lineages (Salvador-Martinez *et al.*, 2020) and the cardiopharyngeal gene network in urochordates, respectively.

DrosAfrica: Building an African biomedical research community using *Drosophila*

As a special session, we had the great opportunity of listening to one of the co-founders of DrosAfrica, María Dolores Martín-Bermudo (CABD, Sevilla). She gave us an overview of this fantastic initiative to help African laboratories to implement biomedical research using *Drosophila melanogaster* as a model. Martín-Bermudo explained to us how this idea was born from discussions with the other co-founders, Marta Vicente-Crespo and Isabel Palacios and quickly inspired other researchers to join the initiative. Since it was created, DrosAfrica has brought together researchers from Europe and Africa, has organized several courses and workshops and helped to create an interconnected community of biomedical scientists in several African countries (Martín-Bermudo *et al.*, 2017).

Regeneration

Last but not least, we had the regeneration session. During the last years, it has been demonstrated that the cross-regulation of signaling pathways is a key determinant in promoting and modulating regeneration. We had the honour to count with Florenci Serras (University of Barcelona) to open the session. He told us about his work, using *Drosophila* wing discs as a model organism for tissue regeneration and focused on the mechanisms of damage sensing in epithelial tissues. He explained that upon physical injury, the Apoptosis signal-regulating kinase 1 (Ask1) acts as an intracellular sensor of Reactive Oxygen Species (ROS). Although high-levels of Ask1 result in apoptosis, in living cells downstream of the insulin pathway the Akt kinase modulates the activity of Ask1. This results in moderate activation of JNK and p38, and in consequence a regenerative response is triggered (Santabàrbara-Ruiz *et al.*, 2019).

Next, we listened to two selected oral presentations. Daniela Romão (IRB Barcelona) explained us how inflammation is coupled to maturation defects. Using an epithelial model of malignant transformation in *Drosophila* she demonstrated that malignant



Fig. 4. The three winning images from the photo competition sponsored by the journal *Developmental Biology*.

cells activate JNK signaling, driving the expression of Ecdysone negative regulator molecules from muscle or hemolymph that delay normal developmental timing. Filipa Simões (University of Oxford) showed us data from two different animal models demonstrating that macrophages directly contribute collagen to scar formation after heart damage, suggesting that myofibroblasts are not the only contributors in scar formation (Simões *et al.*, 2020). The session ended with four selected flash talks: the first from María Ester De la Cruz Crespillo (CNIC, Madrid) showed the epicardial expression of Meis transcription factors and the contribution to heart and vasculature development in mice. Her results showed that Meis are needed for an epicardial non-autonomous effect on cardiac lymphatic vasculature. Next, Alejandro Castilla-Ibeas (IBBTEC, Cantabria) presented his results on digit limb regeneration in mice and the requirement of nails. His results suggest a central role in digit regeneration for LARM1/2 and presented this model to study the mechanisms of regenerative blastema. Then Helena García-Castro (University of Barcelona) told us about ACME (ACetic-MEthanol) a cell dissociation technique for single-cell sequencing amenable for regeneration studies and, finally, Elena Gracia-Latorre (IRB Barcelona) showed us the regulation of wingless in *Drosophila* (WNT in mammals), in particular she demonstrated the regulation of Wg expression under a specific enhancer and the contribution to the regeneration capacity of epithelium under tumoral conditions.

Prizes and closing session

During the closing session of the meeting, prizes were announced, all evaluated by designated scientific committees. First, the winners of a Photography Competition sponsored by the journal *Developmental Biology* were awarded. In the photo SciArt competition there were many beautiful images from different developmental biology models and methods. The winning image, a ferret kid brain section named “Ferret Butterfly” was authored by Victor Borrell (Neurosciences Institute, Alicante). Second prize went to Veronica Murcia (Neurosciences Institute, Alicante) with a growth cone image she entitled “Flower Thistle”. Last but not least, Ettore de Giorgio (IBMB-CSIC, Barcelona) got the third prize with a *Drosophila* embryonic trachea photo he called “Roots and Branches” (Fig. 4). This was followed by the best poster prizes awarded by the SEBD. The first prize went to Carlos Camilleri-Robles (University of Barcelona), who presented his results on

Regeneration of *Drosophila* wing imaginal discs. The 2nd prize went to Daniel del Toro (University of Barcelona) for his poster on guidance of migrating neurons. Two 3rd prizes were awarded, one for Cruz Morenilla-Palao (Neurosciences Institute, Alicante) and one for José Santos-Pereira from (CABD-CSIC), on the formation of bilateral circuits and zebrafish gene regulation, respectively.

At the end of the meeting, the SEBD’s president Miguel Torres (CNIC, Madrid) announced the two winners of the “José Luis Gómez-Skarmeta Award to Scientific excellence in *Developmental Biology*” for young PIs. Alvaro Rada-Iglesias (IBBTEC, Cantabria) and Manuel Irimia (CRG, Barcelona) won this prize *ex-aequo* for their contributions to genome regulation in development. Also announced were the “SEBD Awards for scientific excellence in doctoral theses”, given to Diana García Morales (CABD, Sevilla), Pedro Javier Gómez Gálvez (IBiS, Sevilla) and Cristina Sánchez Fernández (University of Cantabria) for their outstanding Ph.D. work. Congratulations to all awardees for their achievements.

The closing ceremony finished on a good note, with the delivery of a live flower bouquet to Rosa Barrio (CIC Biogune) for her work in the organizing committee. And then we said goodbye, hoping that next time we will be able to have our annual meeting back to normal.

The organizers tried to palliate the disadvantages of the virtual format, i.e. the difficulties for personal interactions, by promoting live presentations, followed by live Q&A sessions, and habilitating Slack channels for each oral and poster presentation. Face-to-face meeting were encouraged via Remo during the poster sessions and social hours. Oral presentations were recorded and available to participants for the following week, as well as the Slack channels for discussion. Nothing can replace the human, vivid interactions that take place during the meetings, but we were able to enjoy splendid scientific presentations and discussions, not only by Spanish groups, but also by groups beyond the borders (other European countries, Brazil, Mexico, Australia). Now, it is time to start thinking and planning the next SEBD meetings!

References

- ARAÚJO, S.J. (2018). Opening the doors of scientific conferences to local citizens. *The Node*, November 28th, 2018, <https://thenode.biologists.com/opening-the-doors-of-scientific-conferences-to-local-citizens/outreach>

- BHIDE, S., GOMBALOVA, D., MÖNKE, G., STEGMAIER, J., ZINCHENKO, V., KRESHUK, A., BELMONTE, J.M. and LEPTIN, M. (2020). Mechanical competition alters the cellular interpretation of an endogenous genetic programme. *bioRxiv*2020.10.15.333963.
- BLECKWEHL, T., SCHAAF, K., CRISPATZU, G., RESPUELA, P., BARTUSEL, M., BENSON, L., CLARK, S.J., DORIGHI, K.M., BARRAL, A., LAUGSCH, M. *et al.*, (2020 PREPRINT). Enhancer priming by H3K4 methylation safeguards germline competence. *bioRxiv*2020.07.07.192427.
- BORSARI, B., VILLEGAS-MIRÓN, P., LAAYOUNI, H., SEGARRA-CASAS, A., BERTRANPETIT, J., GUIGÓ, R. and ACOSTA, S. (2020). Intronic enhancers regulate the expression of genes involved in tissue-specific functions and homeostasis. *bioRxiv*2020.08.21.260836.
- BUONO, L., NARANJO, S., MORENO-MARMOL, T., DE LA CERDA, B., POLVILLO, R., DÍAZ-CORRALES, F.-J., BOGDANOVIC, O., BOVOLenta, P. and MARTÍNEZ-MORALES, J.-R. (2020). Analysis of gene network bifurcation during optic cup morphogenesis in zebrafish. *bioRxiv*2020.05.28.121038.
- DEL TORO, D., CARRASQUERO-ORDAZ, M.A., CHU, A., RUFF, T., SHAHIN, M., JACKSON, V.A., CHAVENT, M., BERBEIRA-SANTANA, M., SEYIT-BREMER, G., BRIGNANI, S. *et al.*, (2020). Structural Basis of Teneurin-Latrophilin Interaction in Repulsive Guidance of Migrating Neurons. *Cell* 180: 323-339.e19.
- DIAS LOURO, M.A., BETTENCOURT-DIAS, M. and BANK, C. (2020). Patterns of selection against centrosome amplification in human cell lines. *bioRxiv*2020.01.24.918615.
- FABRA-BESER, J., DE ARAUJO, J.A.M., MARQUES-COELHO, D., GOFF, L.A., MÜLLER, U. and GIL-SANZ, C. (2020). Differential expression levels of Sox9 in early neocortical radial glial cells regulate the decision between stem cell maintenance and differentiation. *bioRxiv*2020.12.09.417931.
- FERNANDEZ-GUERRERO, M., YAKUSHIJI-KAMINATSUI, N., LOPEZ-DELISLE, L., ZDRAL, S., DARBELLAY, F., PEREZ-GOMEZ, R., BOLT, C.C., SANCHEZ-MARTIN, M.A., DUBOULE, D. and ROS, M.A. (2020). Mammalian-specific ectodermal enhancers control the expression of *Hoxc* genes in developing nails and hair follicles. *Proc Natl Acad Sci USA* 117: 30509-30519.
- FRANKE, M., DE LACALLE-MUSTIENES, E., NETO, A., ACEMEL, R.D., TENA, J.J., SANTOS-PEREIRA, J.M. and GÓMEZ-SKARMETA, J.L. (2020). CTCF knockout in zebrafish induces alterations in regulatory landscapes and developmental gene expression. *bioRxiv*2020.09.08.282707.
- GONZALEZ-GOBARTT, E., BLANCO-AMEJEIRAS, J., USIETO, S., ALLIO, G., BENAZERAF, B. and MARTÍ, E. (2020). Cell intercalation driven by SMAD3 underlies secondary neural tube formation. *bioRxiv*2020.08.24.261008.
- GUALLAR, D., FUENTES-IGLESIAS, A., SOUTO, Y., AMENEIRO, C., FREIRE-AGUILLEIRO, O., PARDAVILA, J.A., ESCUDERO, A., GARCIA-OUTEIRAL, V., MOREIRA, T., SAENZ, C. *et al.*, (2020). ADAR1-Dependent RNA Editing Promotes MET and iPSC Reprogramming by Alleviating ER Stress. *Cell Stem Cell* 27: 300-314.e11.
- HU, H., UESAKA, M., GUO, S., SHIMAI, K., LU, T.-M., LI, F., FUJIMOTO, S., ISHIKAWA, M., LIU, S., SASAGAWA, Y. *et al.*, (2017). Constrained vertebrate evolution by pleiotropic genes. *Nat Ecol Evol* 1: 1722-1730.
- LÓPEZ-GAY, J.M., NUNLEY, H., SPENCER, M., DI PIETRO, F., GUIRAO, B., BOSVELD, F., MARKOVA, O., GAUGUE, I., PELLETIER, S., LUBENSKY, D.K. *et al.*, (2020). Apical stress fibers enable a scaling between cell mechanical response and area in epithelial tissue. *Science* 370: eabb2169.
- LUKOSEVICIUTE, M., GAVRIOUCHKINA, D., WILLIAMS, R.M., HOCHGREB-HAGELE, T., SENANAYAKE, U., CHONG-MORRISON, V., THONGJUEA, S., REPAPI, E., MEAD, A. and SAUKA-SPENGLER, T. (2018). From Pioneer to Repressor: Bimodal foxd3 Activity Dynamically Remodels Neural Crest Regulatory Landscape In Vivo. *Dev Cell* 47: 608-628.e6.
- M. REAL, F., HAAS, S.A., FRANCHINI, P., XIONG, P., SIMAKOV, O., KUHL, H., SCHÖPFLIN, R., HELLER, D., MOEINZADEH, M.-H., HEINRICH, V. *et al.*, (2020). The mole genome reveals regulatory rearrangements associated with adaptive intersexuality. *Science* 370: 208-214.
- MARTÍN-BERMUDO, M.D., GEBEL, L. and PALACIOS, I.M. (2017). DrosAfrica: Building an African biomedical research community using *Drosophila*. 1-7.
- MATSUDA, M., HAYASHI, H., GARCIA-OJALVO, J., YOSHIOKA-KOBAYASHI, K., KAGEYAMA, R., YAMANAKA, Y., IKEYA, M., TOGUCHIDA, J., ALEV, C. and EBISUYA, M. (2020). Species-specific segmentation clock periods are due to differential biochemical reaction speeds. *Science* 369: 1450-1455.
- NABAIS, C., PESSOA, D., DE-CARVALHO, J., VAN ZANTEN, T., DUARTE, P., MAYOR, S., CARNEIRO, J., TELLEY, I.A. and BETTENCOURT-DIAS, M. (2020). Plk4 triggers autonomous de novo centriole biogenesis and maturation. *bioRxiv*2020.04.29.068650.
- PACHANO, T., SÁNCHEZ-GAYA, V., MARINER-FAULÍ, M., EALO, T., ASENJO, H.G., RESPUELA, P., CRUZ-MOLINA, S., VAN IJCKEN, W.F.J., LANDEIRA, D. and RADA-IGLESIAS, Á. (2020). Orphan CpG islands boost the regulatory activity of poised enhancers and dictate the responsiveness of their target genes. *bioRxiv*2020.08.05.237768.
- RAYON, T., STAMATAKI, D., PEREZ-CARRASCO, R., GARCIA-PEREZ, L., BARRINGTON, C., MELCHIONDA, M., EXELBY, K., LAZARO, J., TYBULEWICZ, V.L.J., FISHER, E.M.C. *et al.*, (2020). Species-specific pace of development is associated with differences in protein stability. *Science* 369: eaba7667.
- RICOLO, D. and ARAÚJO, S.J. (2020). Coordinated crosstalk between microtubules and actin by a spectraplakin regulates lumen formation and branching. *eLife* 9: e61111.
- SALVADOR-MARTÍNEZ, I., GRILLO, M., AVEROF, M. and TELFORD, M.J. (2020). CeLaVi: An Interactive Cell Lineage Visualisation Tool. *bioRxiv*2020.12.14.422765.
- SÁNCHEZ-HUERTAS, C., BONHOMME, M., FALCO, A., FAGOTTO-KAUFMANN, C., VAN HAREN, J., JEANNETEAU, F., GALJART, N., DEBANT, A. and BOUDEAU, J. (2020). The +TIP Navigator-1 is an actin-microtubule crosslinker that regulates axonal growth cone motility. *J Cell Biol* 219: e201905199.
- SANTABÁRBARA-RUIZ, P., ESTEBAN-COLLADO, J., PÉREZ, L., VIOLA, G., ABRIL, J.F., MILÁN, M., COROMINAS, M. and SERRAS, F. (2019). Ask1 and Akt act synergistically to promote ROS-dependent regeneration in *Drosophila*. *PLoS Genet* 15: e1007926.
- SIMÕES, F.C., CAHILL, T.J., KENYON, A., GAVRIOUCHKINA, D., VIEIRA, J.M., SUN, X., PEZZOLLA, D., RAVAUD, C., MASMANIAN, E., WEINBERGER, M. *et al.*, (2020). Macrophages directly contribute collagen to scar formation during zebrafish heart regeneration and mouse heart repair. *Nat Commun* 11: 600.
- UESAKA, M., KURATANI, S., TAKEDA, H. and IRIE, N. (2018). Evolutionary transition in accessible chromatin landscapes during vertebrate embryogenesis. *bioRxiv*481309.

Further Related Reading, published previously in the *Int. J. Dev. Biol.*

A small great history of the sister Societies of Developmental Biology in Spain and Portugal

Isabel Palmeirim and Juan Aréchaga
Int. J. Dev. Biol. (2009) 53: 1261-1268
<https://doi.org/10.1387/ijdb.082714ip>

Contributions to Neuroembryology of Santiago Ramon y Cajal (1852-1934) and Jorge F. Tello (1880-1958)

Luis Puelles
Int. J. Dev. Biol. (2009) 53: 1145-1160
<https://doi.org/10.1387/ijdb.082589lp>

Early bases of modern Embryology in Spain: Microscopical Anatomy and the introduction of Cell Theory and Histology in their scientific and social European context

Roberto Marco-Cuellar(†) and Juan Aréchaga
Int. J. Dev. Biol. (2009) 53: 1123-1143
<https://doi.org/10.1387/ijdb.093020rm>

A glance at Spanish Embryology and Teratology during the XX Century through the academic life of Francisco Orts-Llorca (1905-1993)

Juan Aréchaga, Juan Jiménez-Collado and Domingo Ruano-Gil
Int. J. Dev. Biol. (2009) 53: 1165-1177
<https://doi.org/10.1387/ijdb.072492ja>

José-Antonio Campos-Ortega (1940-2004) and his scientific work - a personal perspective

Elisabeth Knust and Rainer Hertel
Int. J. Dev. Biol. (2009) 53: 1193-1203
<https://doi.org/10.1387/ijdb.072480ek>

A history of Evo-Devo research in Spain

Jaume Baguña
Int. J. Dev. Biol. (2009) 53: 1205-1217
<https://doi.org/10.1387/ijdb.072427jb>

Teaching and research on Developmental Biology in Portugal

Sólveig Thorsteinsdóttir, Gabriela Rodrigues and Eduardo G. Crespo
Int. J. Dev. Biol. (2009) 53: 1235-1243
<https://doi.org/10.1387/ijdb.082692st>

