

Fungal Nomenclature at IMC10: Report of the Nomenclature Sessions

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Abstract: Three Nomenclature Sessions were convened during the 10th International Mycological Congress (IMC10) in Bangkok on 3–8 August 2014. In addition a Questionnaire was given to all delegates. This Report reviews and summarizes the views expressed in the Sessions and in the responses to the Questionnaire. The issues covered related to aspects of: registration, protected names, forgotten names, pleomorphic fungi, lichenized fungi, typification, diagnoses, and governance. In addition, reports were received from working groups preparing lists of names to be proposed for protection, and controversial cases of competing names were discussed. The Congress was mandated to ratify decisions of the Nomenclature Committee for Fungi (NCF) on the appointment of repositories for the registration of new fungal names. After discussion in the Sessions on the decision of the NCF to appoint three such bodies, a Resolution to that effect was approved by the Congress. The Congress also adopted a Resolution asking that the opinions of mycologists on future directions for the nomenclature of fungi be taken into account in formulating changes in the rules for consideration at the International Botanical Congress in 2017.

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INTRODUCTION

Nomenclature Sessions convened over three days at the 9th International Mycological Congress (IMC9) in Edinburgh in 2010, and an associated Questionnaire given to all delegates, were instrumental in guiding proposals to modify provisions in the then *International Code of Botanical Nomenclature* (ICBN; McNeill *et al.* 2006) related to fungi. The report of the 2010 Sessions (Norvell *et al.* 2010), and subsequent debates on key points at an international symposium in Amsterdam the following April, led to ‘The Amsterdam Declaration’ which expressed guidance on the directions in which various aspects of fungal nomenclature might proceed (Hawksworth *et al.* 2011). Those views, and the counter-proposals they precipitated, contributed significantly to the debate that led to the adoption of a variety of changes to the rules relating to the nomenclature of fungi by the Nomenclature Section of the XVIII International Botanical Congress (IBC), meeting in Melbourne in July 2011 (Hawksworth 2011; Flann *et al.* 2014). All the substantive issues were formulated into proposals and adopted by the IBC, some with modifications arising from discussions by mycologists during the Section meetings. The exception

was governance, which was referred to a newly formed Special Committee charged with reporting to the next IBC in Shenzhen, China, in 2017.

Following the Melbourne Congress, it became clear that various changes made and incorporated in the resultant and now re-named *International Code of Nomenclature for algae, fungi, and plants* (ICN; McNeill *et al.* 2012) perhaps merited some adjustments and clarifications to meet fully the requirements of mycologists. As the 10th International Mycological Congress (IMC10) meeting in Bangkok in 2014 would be the last before the 2017 IBC, it was appropriate to take that opportunity to obtain the views of mycologists as to what further refinements or changes might be made. In addition, the ICN (Art. 42.3) charged the IMC with ratifying the decisions of the Nomenclature Committee for Fungi (NCF) with respect to the appointment of repositories for information on newly introduced names of fungi and the issuing of identifiers required for their valid publication.

A possible set of proposals for changes was compiled following feedback from mycologists, especially during the international ‘One Genus = Which Gene?’ symposium held in Amsterdam in April 2013 (Hawksworth 2014). Those proposals were subject to further discussion at the ‘Genera of Fungi’ symposium in Amsterdam the following April (Anon.

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2014) and were distilled into a Questionnaire included in the delegate packs of all 921 mycologists who were full registrants at the 10th International Mycological Congress (IMC10) in Bangkok on 3–8 August 2014.

It was explicitly stated on the Questionnaire that the Nomenclature Sessions and the Questionnaire were intended only to guide further debate and the subsequent formulation of proposals for the 2017 IBC, and that no binding decisions or votes were to be taken at IMC10 apart from that on ratifying the appointment of repositories as required by the ICN.

Nomenclature Sessions at IMC10 were held from 13.30–15.30 h on 4, 5, and 7 August 2014, with the topics intended to be covered in each Session listed on the back of the circulated Questionnaire. The Sessions were chaired by Scott A. Redhead (Chair, NCF), who was assisted by a panel comprising Vincent Demoulin (General Committee on Nomenclature), David L. Hawksworth (General Committee on Nomenclature and Rapporteur for the Sessions), Keith A. Seifert (Chair, International Commission on the Taxonomy of Fungi, ICTF), and Nicholas Turland (Rapporteur-général for the 2017 IBC Nomenclature Section). The number of participants in each Session varied, and some mycologists left or joined while they were still in progress. The numbers attending each day were approximately 90, 74, and 77, respectively. Questionnaires were accepted up to the end of the Congress, and the total received with at least one question answered was 117; a place for individual comments was also included on the form, and delegates were asked to sign them to avoid multiple submissions. One Questionnaire was copied and sent in remotely and considered but not counted. Thirteen Questionnaires were received unsigned. Those completing forms were given the option of leaving blank any questions. We have interpreted such unanswered questions to be “null” votes which may reflect that they had no particular views, were undecided, had alternative views, or the questions were not relevant to their interests. The total of 104 signed copies or 117 (if including the unsigned copies) represents 11–13 % of the IMC10 delegates. Tallies from the Questionnaire were not presented to the Sessions apart from a preliminary count in relation to the questions pertinent to fungal name registration, which was to be discussed at the third Session; the results from the Questionnaire are made available here as Table 1. Percentages were compared between tallies both including and excluding signatures and were found to vary by less than 3 % and did not substantially alter the outcomes. As 60 % assenting is the accepted percentage required for a change to the *Code* at Nomenclature Section meetings of the IBC, questions which gained more than that percentage are here indicated in red in Table 1.

In addition to discussions on possible changes in the ICN relating to fungi, the Sessions also received presentations from representatives of the various working groups developing lists of names for possible protection or suppression under the ICN. At the final Session, the wording of two Resolutions to submit for adoption at the Closing Plenary Session of the Congress (the General assembly of the International Mycological Association; IMA) was also discussed.

This Report summarizes the discussions on the topics covered in the Questionnaire, the views on those as reflected in the answers to that Questionnaire, any additional pertinent

comments made in the Comments box on the form, key issues arising from the presentations of particular lists of names, and the agreed Resolutions. The topics are treated here in the order in which they were presented on the Questionnaire except for the questions on ratification of the appointment of repositories, which were discussed on the last day, after which votes were tallied.

PREAMBLE

Redhead presented an overview of the previous nomenclature sessions at IMC9 in Edinburgh and the subsequent Nomenclature Section at the XVIII IBC in Melbourne and outlined how the various topics would be addressed in the three sessions at IMC10. Somewhat later in the sessions he introduced the other six NCF members attending IMC, José Dianese, Paul Kirk, Tom May, Shaun Pennycook, Dagmar Triebel (who attend the first two session), Yi-Jian Yao, and sent regrets from the exiting secretary, Lorelei Norvell.

REGISTRATION

Art. 42.3 of the ICN empowered the NCF to appoint one or more recognized repositories to accession the required information and issue an identifier, “subject to ratification by a subsequent International Mycological Congress”. The NCF had voted to support multiple official repositories (71 %), and decided to appoint three electronic repositories: MycoBank (82 %), Index Fungorum (71 %), and Fungal Names (71 %), each voted upon separately within the NCF (Redhead & Norvell 2012, 2013).

Prior to the discussion of this topic in the third nomenclature session, pertinent separate talks were presented in congress symposia by Redhead (“Is the registration of fungal names actually working?”), Paul M. Kirk (“Workflows for nomenclatural and taxonomic data in mycology: Index Fungorum, Species Fungorum and the GNA”), and Vincent Robert (“MycoBank and sequence-based fungal taxonomy”), explaining how the system was operating and how it was anticipated it might develop in the future.

Redhead introduced the discussion in session one and indicated it would be addressed in detail in the third session. He also indicated that separate votes would be tallied for each repository, in part because health issues for both the secretary and chair of the NCF in 2013–14 meant that the NCF had not had time to fully evaluate progress since a 2012 agreement between the three repositories had been signed. Therefore, as Chair of the NCF, he believed that the delegates at the Session and members of the Congress should be given full opportunity to evaluate the situation for each repository and to make an informed democratic choice. The main problem identified was that of synchronization of data exchange between the three repositories, as foreseen in the Memorandum of Cooperation (MoC) between them signed in 2012 (*cf.* Redhead & Norvell 2012). Redhead noted that despite the signed agreement, there had been very few reciprocal exchanges of data, only once or twice a year, and therefore there was no real-time flow of data. Not all comments were captured in the heat of the

resulting debate. *Robert* indicated that a program had been written and existed to facilitate data exchange and was in hand at MycoBank. *Kirk* questioned whether the central server in the schematic diagram in the 2012 agreement was or should have been the MycoBank server. He also questioned the competency of any member of the session in understanding the level of programming involved for synchronization. *Robert* iterated that he did. He also expressed surprise that it was not fully understood that the central server was to be MycoBank as it was not cost effective to set up another site. *Peter Buchanan* believed that the MoC had interpreted the diagram as indicating that there was to be a separate central server. *Redhead* noted that there had been a period of instability while *Kirk* was transferred from CABI to the Royal Botanic Gardens Kew, and Index Fungorum was migrated from servers at CABI to Landcare Research (NZ) and later to Kew, and that the lack of synchrony was leading to numerous discrepancies. Now that Index Fungorum was based at the Royal Botanic Gardens Kew, *Hawksworth* hoped that integration could be accelerated. *Pedro Crous* raised the issue of comparing apples with oranges and suggested that MycoBank alone be used to register names and that Index Fungorum focus on nomenclature, adding that he regularly consulted IF for quick nomenclatural overviews. He believed that such an arrangement would be the most efficient use of resources and that an offer had been made to collaborate in such a way. He was also of the opinion that registration was currently in a mess. Difficulties also arose because of nomenclatural errors or misunderstandings, and various instances where problems had arisen were discussed; most were not, however, actually due to errors in the databases. *Paul Cannon* saw the shortage of mycologists with nomenclatural expertise as a particular problem, and participants acknowledged that they generally used Index Fungorum as the reference nomenclator. He suggested there be encouragement for supporting multiple registries. *Crous* and *John Taylor* indicated that they may well set up many new repositories that would be synchronized. *Redhead* noted that technically none would or could be immediately recognized as official by the NCF.

Comments: Several mycologists remarked on the Questionnaires as to whether it had been appropriate to have separate questions on each of the repositories appointed by the NCF, rather than a single one to approve the decision. However, as the NCF had voted on the three repositories separately (*Redhead & Norvell 2013*), *Redhead* considered it appropriate and necessary to ratify each separately. Some felt that having more than one repository was a massive duplication, while others felt it either increased personal choice or was in the interests of long-term security. One member of the NCF noted that none of the three centres had any mandate to promote itself to the role of “primary hub”. Synchronization or mirroring of the three databases was emphasized as essential by several respondents. Another NCF member was of the view that the evaluation period extended to 2017, at which time functionality of the system might be better evaluated. We note, however, that it is only the MoC that runs until 2017, while the ICN rules that any decision by the NCF on repositories is subject to ratification by a subsequent IMC; the next IMC being in 2018. *Peter*

Johnston (writing in remotely from New Zealand) considered that the system used should be compatible with whatever is to be established for plant names, and that there was need to discuss support beyond that which could be supplied by individual institutions.

Halfway through the third nomenclature session, after discussing the registration of names, the remaining Questionnaires were gathered and a quick tally of votes for each of the repositories was made by two volunteers (*Hai Nguyen* and *Joey Tanney*) and reported by *Redhead*. All three repositories had received more than 60 % support in the returned Questionnaires (Table 1, Q. 1–3), and a Resolution to reflect this was drafted and approved by 63 of those then present in the Session, with none against but a few abstentions. That Resolution was then forwarded to the Closing Plenary Session of IMC10 (see p. 460).

The issue of whether the registration database should serve as the only place for the valid publication of new fungal names, as a means of ensuring the registration data matched the name and identifier (Q. 4), was not discussed in the Session. This possibility received just over 60 % support in the Questionnaire indicating either a strong desire to standardize fungal name validations or dissatisfaction with current practices, but this topic requires wider debate before any formal proposals to change the *status quo* are made. In particular, there are implications for the publication of new scientific names of fungi in books and journals.

Comments: One participant expressed concern over how peer review could be guaranteed in such a system, and felt that there must be a link to a peer-reviewed paper. One NCF member also strongly disagreed with this idea if the proposal meant that peer review would be removed, as seemed to be the case.

PROTECTED NAMES

Hawksworth summarized the provisions of the ICN in relation to the development of lists of protected and/or suppressed names of fungi, and stressed that, although stimulated by the ending of dual nomenclature for pleomorphic fungi, the provisions were not limited to them. There was an issue of whether names included on lists should be protected only against names listed as rejected in their favour (currently supported by Art. 14.3), or also against any unlisted names that might be found to compete with them (which would require a change to the ICN *via* a new proposal). *Turland* pointed out that there was a precedent in the ICN for names to be protected against unlisted names in Appendix IIB which comprised family names of bryophytes and spermatophytes to be retained with precedence over any unlisted synonyms. *Redhead* added that there was a history of fungal drift away from the core of the ICN where some common botanical practices had proved to be impractical when applied to fungi. *Kirk* did not see any problem with having lists protected against unlisted names as any mistakes could be rectified through the existing conservation and rejection procedures. *Demoulin* was not against the protection principle, and

Table 1. Results of responses to questionnaire included in all delegates packs at IMC10 ((percentage “Yes” votes over 60 % of votes cast indicated in **red bold** type).

| Topic | Question (Explanatory comments in [. . .] brackets) | Number of votes | Yes | No | Percentage “Yes” votes / Number of votes cast | Percentage “Yes” / Total number of Questionnaires returned |
|--------------------------|---|-----------------|-----|----|---|--|
| REGISTRATION | | | | | | |
| 1 | Fungal Names (hosted by the Chinese Academy of Science, Beijing, China) | 86 | 56 | 30 | 65.1 % | 47.8 % |
| 2 | Index Fungorum (hosted by Landcare NZ and Royal Botanic Gardens Kew, UK) | 108 | 86 | 22 | 79.6 % | 73.5 % |
| 3 | Mycobank (owned by IMA, hosted by the CBS-KNAW Fungal Biodiversity Centre, Utrecht, The Netherlands) | 113 | 113 | 0 | 100.0 % | 95.7 % |
| 4 | Would you favourably view [making the registration database the only place for valid publication]? | 96 | 58 | 38 | 60.4 % | 49.7 % |
| PROTECTED NAMES | | | | | | |
| 5 | Do you favour the creation of lists of such protected names [i.e. ones protected against listed and unlisted names]? | 106 | 94 | 12 | 88.6 % | 80.3 % |
| 6 | Do you favour the creation of a list of suppressed fungal names? | 101 | 49 | 52 | 48.5 % | 41.8 % |
| 7 | The new lists should be referred to as “protected” (names to be used) and “suppressed” (names not be used) | 95 | 84 | 11 | 88.4 % | 71.7 % |
| 8 | The current list of “sanctioned” publications (i.e. works in which the names used are protected from any competing names) should be extended (i.e. not restricted to selected works of Fries and Persoon) | 83 | 43 | 40 | 51.8 % | 36.8 % |
| 9 | The term “sanctioned” should be replaced by “protected” and the accepted names in the former sanctioning works should be incorporated into the protected lists. | 80 | 51 | 29 | 63.8 % | 43.5 % |
| 10 | Provided that the term “sanctioned” is replaced by “protected”, the use of the “.” indicating the sanctioned status of a name should be discontinued | 71 | 51 | 20 | 71.8 % | 43.5 % |
| FORGOTTEN NAMES | | | | | | |
| 11 | In principle, names published before a set date (e.g. 1900) and not included in the appointed repositories of names should no longer be treated as validly published | 101 | 43 | 58 | 42.5 % | 36.7 % |
| 12 | In principle, names not used (except in lists of synonymy or compilations of literature records but unrecognized) for 60 years are not allowed to displace currently accepted and used names for the same taxon | 102 | 48 | 54 | 46.6 % | 41.0 % |
| PLEOMORPHIC FUNGI | | | | | | |
| 13 | In principle, names typified by a sexual, or by an asexual morph should be treated equally nomenclaturally when determining which name should be adopted | 101 | 94 | 7 | 93.0 % | 80.3 % |
| 14 | In principle, if prior to 2013, in naming a newly discovered morph of a species, an author used the same species epithet as the adopted earlier species name, the later name should be treated as a new combination (if it does not violate other rules) and not a new species name (and the author citation corrected accordingly) | 84 | 73 | 11 | 86.9 % | 62.3 % |

Table 1. (Continued).

| Topic | Question (Explanatory comments in [. . .] brackets) | Number of votes | Yes | No | Percentage "Yes" votes / Number of votes cast | Percentage "Yes" / Total number of Questionnaires returned |
|--|--|-----------------|-----|----|---|--|
| LICHENIZED FUNGI | | | | | | |
| 15 | Exemptions for lichen-forming fungi preventing their names being included in lists of protected and suppressed names should be removed, so that all fungal names are treated equally regardless of their biology | 85 | 76 | 9 | 89.4 % | 64.9 % |
| TYPIIFICATION | | | | | | |
| 16 | After 31 December 2018, later acts of typification (i.e. epi-, lecto-, and neo-typifications) must be recorded in one of the approved repositories in order to be accepted | 105 | 100 | 5 | 95.2 % | 85.7 % |
| 17 | Permit sequenced epitypes to be designated to fix the application of species names without first having to establish DNA is not recoverable from the type they represent | 92 | 62 | 30 | 67.3 % | 52.9 % |
| 18 | Subject to development of minimum standards, permit the naming of fungi known only as environmental sequences (i.e. with no specimens or cultures) | 102 | 45 | 57 | 44.0 % | 38.4 % |
| DIAGNOSES | | | | | | |
| 19 | Require a statement of the features that distinguish a new taxon from those already known (i.e. a diagnosis) for valid publication (with or without a full description) | 106 | 90 | 16 | 84.9 % | 76.9 % |
| GOVERNANCE | | | | | | |
| 20 | In general decisions peculiar to fungal nomenclature should be voted at International Mycological and not International Botanical Congresses | 111 | 104 | 7 | 93.6 % | 88.8 % |
| 21 | The Nomenclature Committee for Fungi (NCF) members should be appointed by International Mycological and not International Botanical Congresses | 109 | 106 | 3 | 97.2 % | 90.5 % |
| Total number of questionnaires returned with at least one question answered | | 117 | | | | |

had been in favour of the “Names in Current Use” initiative defeated at the Tokyo IBC in 1993, but was afraid of long lists approved without enough reflection time.

The list of names of *Trichocomaceae* (Pitt & Samson 1993), which was the subject of a special vote of the Nomenclature Section meeting in Tokyo in 1993 (Greuter *et al.*, 1994a, b), was concerned with protection of listed against unlisted names. *John Pitt* was especially concerned about retaining the protection of the names in that list over unlisted names, especially as DNA may become more easily recoverable from old dried cultures and specimens which were the types of long-unused names. *Stephen Peterson* endorsed this concern as he had found that in the case of *Trichoderma*, sequences could be recovered from old herbarium material. *Hawksworth* added that some mycologists had questioned whether this status still remained for the list of *Trichocomaceae*, and that the matter had been discussed by the Editorial Committee of the ICN and it was agreed it did. *Redhead* noted that it was not part of the ICN *sensu stricto* revised at each IBC. Debatably, whether it retains its status or not, the update of that list by Pitt *et al.* (2000) would not currently have the same standing.

Of those in the Session, all but four were supportive of the new lists being protected against unlisted as well as any listed names, and the Questionnaires (Q. 5) concurred, with 88 % in support. Only one person present was against the preparation of separate lists of suppressed fungal names (Q. 6), but *Pennycook* had difficulty with the concept which he considered somewhat abstract. *Redhead* felt that the concept of lists of suppressed names should be left, as it might be helpful in certain fungal groups. Q.6 received just 49 % votes in support and 51 % against in the ballot.

Those present were unanimous in support of use of the terms “protected” and “suppressed” for the new categories of Lists of Names (Q. 7), which was consistent with the 88–90 % of support indicated in the Questionnaire.

Comments: One participant expressed support of both protected and suppressed lists of names, provided there was underlying evidence to support why a name was included. *Johnston* stressed that the lists needed to be compiled slowly and with care to minimize mistakes, and was concerned that a slicker feedback system be used, especially to ensure lists for particular groups were synchronized with the overall list of generic names being developed.

Demoulin, who had a poster on sanctioned names at IMC10, explained that the concept originated from Donk for names in volumes 2 and 3 of Fries' *Systema Mycologicum*, and was proposed for extension to that now in use by Kris Pirozynski in 1976 when abolition of later starting points for fungi was being discussed, prior to its adoption in 1981. *Demoulin* had no objection, however, to the idea of developing a new “List of Protected Works” (Q. 7). *Walter Gams* stressed that there must be flexibility as taxonomy progressed. *Seifert* felt that mycologists really needed to take advantage of major works in order to generate lists of names for protection. In answer to a question from *Kirk* as to how mycologists would know if a name had protected status, *Hawksworth* thought this was best indicated in the Index Fungorum entries. If such a route were followed, *Redhead* observed that it would be necessary to be

clear as to which names were sanctioned in any publication. In any lists, it was stressed by *Hawksworth* that this was a nomenclatural device and it was not a particular taxonomy that would be protected; nomenclature and taxonomy always had to be separated. The consensus of the session was to retain the category of sanctioned names as distinct from names on protected lists, although the Questionnaire responses (Q. 9) supported their combination by 60–63.0 %.

Gams wondered why the “:” citation should be suppressed. *May* was convinced it should be dropped, and proposed that as an alternative the phrase “nom. sanct.” be added in formal citations (supported by at least one Questionnaire comment). The importance of the status for typification was stressed by *Redhead*, but *Hawksworth* considered that the issue was that, 33 years after its introduction, even well-known mycologists still cited places and dates of sanctioning instead of places and dates of valid publication; it was also confusing to other biologists who did not understand the significance of the “:”. *Demoulin* considered those problems were overemphasized and a vast majority of mycologists used the “:” correctly. In the Questionnaire, there was 71–72 % support for the discontinuation of “:”, but the phrasing of that question was unfortunate in being linked to the abandonment of the term “sanctioned” (Q. 10), and it is uncertain what the result would have been otherwise.

Comments: *Turland* agreed with the abandonment of the “:” citation except in full bibliographic citations, as was the case with the use of “in”. He also pointed out that it needed to be made clear that names on protected lists were also protected against earlier homonyms

FORGOTTEN NAMES

There was almost no support in the Session for the idea of devaluing pre-1900 names that were not included in the appointed repositories, reflecting the 43 % support in the Questionnaire (Q. 11) and 57 % rejecting the idea. *May* felt there were many such names and there was a danger in rejecting them. There were also what *Richard Summerbell* termed “layman’s names”, type strains that were difficult to recognize but might merit taking up, as with *Cryptococcus gattii* from cats where three strains in CBS did not have the expected DNA barcode. *Redhead* observed that the situation with *Coccidioides* was also a nightmare.

In the case of zoology, *Demoulin* pointed out that works not included in the zoological register were treated as forgotten. The rules relating to forgotten names in the zoological *Code* were complex, however, and the Session was not supportive of similar provisions being introduced for fungal names unused for 60 or more years. The proposal had just 47 % support in the Questionnaire (Q. 12) and 53 % against.

Comment: One commentator considered that this would be of value only for species or genera with poor, broad, or non-existing descriptions. *Johnston* pointed out that there were many reasons why names were forgotten, and those which could not be linked to a recognizable fungus should be forgotten, but others could be easily recognized and taken up.

PLEOMORPHIC FUNGI

Art. 57.2 of the ICN requires, in the case of “widely used” pairs of names, that an earlier name typified by an asexual morph not displace a later name typified by a sexual morph until a proposal to conserve or protect the latter has been submitted and rejected. *Redhead* noted that this was being ignored, as the process was too cumbersome; mycologists were not prepared to delay publication while such formal procedures were in train. *Kirk* reminded the Session that the Preamble of the *Code* had stability of names of taxa as the key aim, and that it also had to consider the usage of names by others outside taxonomy. There was no objection in the Session to the deletion of this provision, a view in accordance with the 93 % support for deletion revealed by the Questionnaire (Q. 13).

Comment: *Demoulin* did not consider the lack of a penalty for not observing the rule an argument for its deletion. At least one commentator indicated that he still would like the teleomorph name to generally take precedence over any earlier anamorph name.

The issue of treating names proposed in the past for newly discovered morphs of a species, which retained the same epithet of the other morph, as combinations rather than new species, was recognized as complex. *Seifert* felt this suggestion to be terrible as it went against the nomenclatural acts. There was also the issue of the names having different types, and *Gams* stressed that these were sometimes now found to be different taxa. *Hawksworth* pointed out that the problem was that the older name would often be that of the first described morph, and that could no longer be recombined without creating a homonym, and there were often unfamiliar names that would then have to be taken up. He did not see misinterpretations as any different from cases where new combinations were made on the basis of wrongly interpreted names, which continued to be typified by the type of the basionym; the types proposed for the later names would thus lose their nomenclatural importance. *Kirk*, however, noted that where there were such cases of misapplication they could be dealt with through the new lists of protected names. *Redhead* had reservations until the proposals were tested, and *Pennycook* wondered if other options were possible. The problem was seen as most acute in the older literature by *Kirk*, who added that there were 100s of cases amongst the rust fungi where this would be relevant.

Although the Session was ambivalent over this suggestion, with no consensus emerging, the proposal to treat such names as new combinations rather than new species names was strongly supported, at 86 %, in the Questionnaire (Q. 14).

Comment: One commentator indicated that he would like to see guidance on this proposal (Q. 14) provided prior to the publication of the next ICN. Another could imagine some complex situations, but if the other state was really of the same species, combinations should be used.

LICHENIZED FUNGI

Redhead explained that when the proposal to exempt the names of lichen-forming and allied fungi from the newly proposed lists of protected and suppressed names was made from the floor at the Melbourne IBC, there had been no opportunity for wider discussions, and it seemed to be an exception made for no apparent reason. As noted by *Gams*, this was historical as lichens had always been exempted from the provisions of the former Art. 59. *Triebel* commented that the situation seemed satisfactory at the moment and *Demoulin* supported the provision, as he had done in Melbourne. *May* was concerned that this might lead to much more work on the preparation of lists of protected names. However, *Redhead* believed that removing the exception would be of benefit.

On the suggestion of *Kirk*, the Session agreed that the views of the International Association for Lichenology (IAL) should be sought. There had been a proposal to establish an International Committee for the Nomenclature of Lichens and Allied Fungi (ICNLAF) by *Lendemer et al.* (2012) but this had not yet been recognized by the IAL. *Hawksworth* noted that lichenologists were well-represented at IMC10, with 63 attending their dinner that week. The proposal to delete the current provision was supported by 89 % of those completing the Questionnaire (Q. 15).

TYPIIFICATION

Gams pointed out that there was already a Recommendation in the *Code* that implied that information on later typifications be deposited in a recognized repository (Rec. 42A.1). *Demoulin* was concerned that we were developing too many rules, but *Kirk* saw this as only a minor extension of current practice. *Hawksworth* pointed out that MycoBank, and he understood also Index Fungorum, now issued unique identifiers for later typifications and that this had already become a requirement for publication in several mycological journals. No objections to this proposal were made at the Session, and it received 95 % support in the Questionnaire (Q. 16).

An additional requirement for types to be deposited in an “official institution” was proposed by *Triebel*, but *Turland* pointed out that would depend where material was already housed in the case of lectotypifications. *May* floated the possibility of having a drop-down list of acceptable institutions on repository sites. While the sentiments were supported, no view on how such a list might be compiled in practice was put forward.

Some mycologists were now routinely designating sequenced cultures or specimens as epitypes to fix the application of names in phylogenetic studies, but without first endeavouring to recover DNA from the name-bearing type to which they related. The issue was over the need to establish whether an existing type was “demonstrably ambiguous”; designation of an epitype for a lectotype in Linnaeus’s herbarium had been called into question as no attempt to recover DNA from it had been attempted (*Jørgensen* 2014). The Session recognized that this was a general problem that did not just concern fungi. *Redhead* considered the matter was

best left to individual taxonomists, and *Turland* commented that the phrase “demonstrably ambiguous” was itself ambiguous. *Demoulin* did not see that there was a problem, as there was no sanction against such epitypifications. The Session did not see a particular advantage in the actual change in the wording proposed, but the concept was supported by 67 % in the Questionnaire (Q. 17).

Comment: A commentator felt that, rather than modifying a clause, it would be better to reformulate the restrictions for introducing an epitype. Another agreed and pointed out that guidance was needed as to how to “establish” that DNA was not recoverable from a type. A third wondered which genes should be attempted to be sequenced. And finally another considered that a statement should be made as to why an attempt was not possible or made to recover DNA from the existing type. The inability to recover DNA was, however, seen as too restrictive an interpretation of the *Code* by *Demoulin*, who stressed that knowledge about the type was a prerequisite for epitypification.

The issue of naming fungi on the basis of DNA sequences recovered from environmental samples in the absence of cultures or specimens was raised repeatedly during presentations at IMC10. The problem had also been highlighted in several publications (*Hibbett et al.* 2010; *Hawksworth et al.* 2011). Time did not permit the topic to be explored during the Sessions, but it had been the subject of presentations during a special evening session, “Classifying, naming and communicating sequence based species”. Labelling (or naming) of environmental sequences was recognized as a problem for which a solution was required. However, the proposal only received support of 44 % in the Questionnaire (Q. 18) with the majority voting against the idea for now (55 %).

Comments: Many comments were submitted on this topic, mostly opposed to the naming of sequences from environmental samples. *Johnston* did not think the technology was yet up to the task, and pointed out that apparent uniqueness of sequences could in some cases be due to sequencing error, unrecognized variability, different ITS copies, or some bias in the methodology. *Demoulin* suggested that sequences might have a nomenclature of their own, as did enzymes and genes, as names were intended only for organisms. A similar view was expressed by another commentator, who considered that a regulated naming system, outside of and invalid under the *Code*, would be sufficient, as practised in the “species hypothesis” system adopted in the UNITE database. One commentator did not view the term “environmental sequences” as scientific and noted that it was not used by the Genomic Standards Consortium; he preferred the use of “DNA sequences”. Another stressed that any named fungus from an environmental sample must be accompanied by a specimen or culture. However, there was also a proposal that a barcode sequence be accepted as an unambiguous and indestructible holotype, and that the current “type specimen” and/or “ex-type culture” be regarded as a “secondary isotype” for the databased holotype. One commentator considered that, while one DNA sequence should be incorporated as a

mandatory item when describing a taxonomic novelty (except possibly for old dried type material from which DNA could not be recovered), it should not be the only characteristic used to describe an organism. In cases where morphology was not available, the commentator felt that a detailed description of the substrate/host/environment and phylogenetic discussion should be provided and subjected to peer review.

DIAGNOSES

Time constraints meant that the Session did not discuss the desirability of requiring diagnoses to be provided for newly described fungi, whether a full description was provided or not. The proposal did, however, receive support of 84 % in the Questionnaire (Q. 19).

Comments: *May* considered that having both a description and a diagnosis could be useful, but was opposed to allowing only a diagnosis. *Turland* noted that the phrase “in the opinion of the author” would need to be added to “Require a statement of the features that distinguish a new taxon from those already known” to make this workable if it were to be a requirement for valid publication (cf. Art. 38.2). Another commentator wished sequence divergences or phylogenetic tree inferences to be allowed to facilitate species descriptions within species complexes.

GOVERNANCE

May explained that he was Convenor of the Special Subcommittee on Governance of the *Code* with Respect to Fungi appointed by the 2011 IBC. The Subcommittee was given the mandate to consider possible changes to the *ICN* in relation to the governance of matters related to the nomenclature of fungi which had been made to that Congress (*Hawksworth et al.* 2009). The Congress had left open the issues of decision-making and elections of members of the Nomenclature Committee for Fungi (NCF).

Discussions within the Subcommittee to date revealed that there was general agreement that elections to the NCF should take place at IMCs, but there was an issue of whether these then needed to be ratified by a subsequent IBC.

With respect to decision-making at IMCs, *May* emphasized that at present the Nomenclature Sessions had no formal status but were informative. There was currently no consensus within the Subcommittee, but the emerging view was that decisions in matters solely relating to fungi should in future be taken at IMCs. More than 60 % of the members of the Subcommittee were currently in favour of the proposals of *Hawksworth et al.* (2009). The Subcommittee now wished to have the views of the mycological community in general.

Gams drew attention to the issue of particular institutions having multiple votes at IBC Nomenclature Section meetings, and he was concerned that sufficient weight be given to mycologists. *Hawksworth* added that with this system, and the ability to transfer votes, a handful of people each carrying perhaps 12 votes could sway a decision. *Seifert* wondered what the views and concerns of algologists were. *Demoulin*



Fig. 1. Selected photographs from the the IMC10 Nomenclatural Sessions. Photos: Scott A. Redhead and David L. Hawksworth.

had attended phycological congresses, and stated that they had never experienced problems with the current situation; no nomenclatural discussions took place at phycological congresses.

May drew attention to the value of the pre-IBC mail votes, and agreed that the situation with respect to institutional votes needed to be improved. The International Association for Plant Taxonomy (IAPT) arranged a mail ballot of its

members, those making proposals and members of the Permanent Nomenclature Committees. For mycology, the IMA could perhaps assume the equivalent role, involving also its regional committees.

May reported that there was no support in the Subcommittee for institutional votes in any future mycological Nomenclature Sessions. *Turland* explained that institutions were allocated 1–7 votes, and that the list was updated

periodically; an institution also had the ability of transferring its votes to a delegate not from that institution ("proxy votes"). The institutions were seen as having a moderating effect. *Hawksworth* said that he had been involved in the process of allocating votes to institutions when a Vice-Rapporteur for the IBC, and did manage to have some mycological centres added, but found the system arbitrary and unable to reflect changing numbers of staff positions in a timely way; he was opposed to the current system. *Kirk* believed in democracy, and pointed out that voting could be done on-line. As details were thrashed out and changes made in IBC Nomenclature Section meetings, *May* explained that the mail votes were considered advisory and that real-time voting was needed. *Kirk* pointed out that this could be done with modern technology. As the policies of institutions could prevent those institutes from sending numbers of their staff, *Demoulin* did not see the dark side portrayed by *Hawksworth*. *Demoulin* went on to point out that this had only been an especial problem at the St Louis IBC in 1999. This had been a key factor in the rejection of proposals for the registration of new names of all groups covered by the *Code* that had been agreed at the Tokyo IBC of 1993 subject to ratification at St Louis.

Hawksworth was gratified that over 10 % of those present at IMC10 had attended the Nomenclature Sessions, and that Questionnaires had been received from about 13 % of the delegates and felt this augured well for the future. *Turland* noted that these figures were similar to those achieved at IBC Nomenclature Section meetings as a proportion of those attending the main congress and that IMCs could be assuming a formal role in decision making at the 2018 IMC. The proposal in the Questionnaire for decision-making on fungal matters to be transferred to IMCs (Q. 20) was overwhelmingly accepted by those present in the Session, with just four against; that question was supported by 93 % in the ballot. On the issue of members of the NCF being elected by IMCs and not IBCs (Q. 21), the Session was almost unanimous, a view reflected in the 97 % support the question received in the ballot.

Comments: One commentator felt that the transfer of decision-making would only be acceptable if provisions similar to those at IBCs were provided at IMCs. In his role as a former Secretary of the NCF, he saw the election of new candidates by members of the Committee as a major mechanism for rejuvenation, for ratification, and possibly supplementation, by an IMC. Several comments related to the limited time available for the Sessions during the Congress, and that it was unfortunate that they overlapped with lunch and Poster Sessions. Another commentator suggested that a day before or after the main Congress be considered in future. Another commented, however, that having this during the congress was an excellent way to garner the opinions of mycologists and get their attention, as that many would not attend separate nomenclature meetings. A third person concurred, commenting that holding these before or after the Congress would radically reduce attendance; he was also strongly opposed to the idea of institutional votes. Writing in, *Johnston* was not convinced that the mycological community was large enough or sufficiently well-supported to implement the structure needed for such a process.

LISTS OF PROTECTED NAMES

The various working groups developing lists of names to propose for protection under the *Melbourne Code* were invited to give short presentations summarizing their membership, how they were operating, the current status of their lists, and highlighting controversial cases where two or more familiar names competed on which they would welcome comments.

Seifert described the processes now in place, which included both Subcommissions of the ICTF and affiliated subcommissions from the IUMS, and *ad hoc* Working Groups that were either self-organized, were convened at the 2012 CBS Spring Symposium, or were commissioned by the ICTF. For this exercise, all groups were instructed to be inclusive to all who wanted to participate, and to attempt to develop consensus for the names discussed. 'The results will ultimately be presented to the NCF for consideration. The lists to be discussed in the Session had either been published or were still in progress. The available lists are all being made available to mycologists at large through the ICTF website.

It was noted that some groups were dealing only with cases where there were competing names, while others were seeking protection for all names. The current *Code* did not allow the latter, but they were being continued with in anticipation of a change in the provisions at the 2017 Congress (see p. 454).

Aspergillus and *Penicillium*

Robert Samson, Chair of the International Commission on *Penicillium* and *Aspergillus* (ICPA) explained that the Commission was unanimous in accepting *Penicillium* (330 species) over competing generic names with type species typified by sexual morphs, apart from *Talaromyces* (85 species) which fell into a separate clade. The situation with *Aspergillus* (338 species) was controversial and three options were identified: (1) Split the genus into a number of small genera characterized by species typified by different sexual morphs; (2) As (1) but re-typify on *Aspergillus fumigatus* to minimize name changes for this medically important fungus; and (3) Retain *Aspergillus* for all species. This last option (3) would require only 18 name-changes, and ICPA voted 8 in favour vs. 2 against. There were few other problems in *Trichocomaceae*, but some smaller genera were still under discussion: *Warcupiella* vs. *Raperia*, *Byssochlamys* vs. *Paecilomyces* and *Dendrosphaera*. Lists of accepted names in *Aspergillus*, *Penicillium*, and *Talaromyces* had recently been published (Samson *et al.* 2014).

Hawksworth stressed the need to be clear that the production of lists of names for protection was a nomenclatural device not to be confused with taxonomy; it was guidance as to which species epithets should be taken up in whatever taxonomy mycologists wished to adopt. As pointed out by *Turland*, names would need to be presented in a system, but it was a mechanism in place to use when deciding on a classification. *May* noted that this reminded him of the Names in Current Use (NCU) initiative. An NCU list of names for the family had been prepared (Samson & Pitt 1993) and given a special status as noted above. *Pitt* did not find the ICPA recommendation acceptable, and commented that the vote had been by a show of hands. Option (3)

would leave *Aspergillus* as paraphyletic, and instead he had suggested that the generic name be re-typified on *A. niger* so that name, which was extensively used in industrial and food mycology, would not change under option (1) (Pitt & Taylor 2014). *Mats Wedin* saw advantages in that interpretation to avoid paraphyly, but *Samson* stated that more recent phylogenetic studies showed that the genus was monophyletic and not paraphyletic. *Samson* further commented that typification of the name *A. niger* could be problematic as three full genome sequences were now available and all differed.

Pitt gave a short presentation explaining that under the proposals of Pitt & Taylor (2014), 11 genera would be recognized in *Aspergillus*. If the present type species were retained, *A. glaucus* with a sexual morph in *Eurotium*, numerous new combinations would then be required. A list of the names to be adopted under that proposal was provided in Pitt & Taylor (2014).

Hawksworth did not consider this the right forum to discuss the matter further, and *Taylor* agreed. *Seifert* noted, however, that there was consensus over *Penicillium* and *Talaromyces* but not over *Aspergillus*.

Colletotrichum

Bevan Weir explained that the working group had 15 members. The main issue identified was whether to adopt *Colletotrichum* over *Glomerella*, which the group supported. They strongly supported the idea of a list of protected names, but there was little support for the preparation of any list of names to be suppressed. There was a particular need to protect the well-established name *C. gloeosporioides*. The lists they were preparing would cover about 112 species, and they were providing full details of all available ex-type cultures including barcode sequences.

Dothideomycetes

Nalin Wijayawardene introduced the work on this major group, which in addition to mycologists listed on the web, had involved many others. Information had been collected on all generic names, whether the type species were typified by sexual or asexual morph types. In deciding which names to adopt, they had considered the availability of cultures and molecular data, the number of epithets, which was the oldest name, use in applied fields, and use in the scientific literature. An overview of the generic names was being finalized for publication (Wijayawardene *et al.* 2014).

Six generic names required critical decisions, of which the most controversial were *Stemphylium* vs. *Pleospora*, *Pyrenophora* vs. *Drechslera*, and *Sphaerellopsis* vs. *Eudarlucia*. *Gams* considered it was important to consider which name was better defined, and which concept was more homogeneous. *Redhead* wondered whether “better defined” should be applied regardless of the morph, and *Cannon* cautioned the Session to recall the situation with *Botryosphaeria*. Finally, *Hyde* urged delegates to e-mail him if they had strong opinions on any particular cases.

Erysiphales

In the absence of *Uwe Braun*, the Session noted that a detailed analysis of cases requiring attention had been

published (Braun 2012), and that formal conservation and rejection proposals based on the analysis had been made (Braun 2013). The Session felt that this work had proceeded in an exemplary way.

Hypocreales

Yuuri Hirooka explained that the working group had been convened by *Amy Y. Rossman* and *Priscila Chaverri*, who were unfortunately not present. They had published a list of names for possible suppression or acceptance following discussion at a workshop organized by the Mycological Society of America (Rossman *et al.* 2013). Seven critical decisions had been made, which meant that the following generic names were proposed for protection: *Clonostachys*, *Fusarium*, *Hypomyces*, *Nectria*, *Neonectria*, *Sphaerostilbe*, and *Trichoderma*. *Crous* was unsure, however, whether *Clonostachys* was best protected over *Gliocladium*.

Seifert commented that the International Subcommittee on *Trichoderma* and *Hypocrea* dealing with *Trichoderma* had voted 3 : 1 for the retention of *Trichoderma* over *Hypocrea*. A full list of the accepted species names in that genus, including necessary new combinations, was currently being prepared for publication by Gary J. Samuels.

In the case of *Fusarium*, which had been worked on by the ISPP International Subcommittee on *Fusarium* Systematics, it was noted that there was still an issue as to how that genus should be defined, but a consensus was reached that that generic name should be retained in a broad sense (Geiser *et al.* 2013).

Joey W. Spatafora explained that he was convenor of a working group of 21 mycologists who had been examining implications for names in *Ophiocordycipitaceae*, and a report of their work had recently been published (Quandt *et al.* 2014). In deciding which names to prefer, they had considered monophyly, priority, usage, and clarity of the generic concept. A consensus had been built, and a number of name changes had been made, mainly as a result of the decision to accept *Tolypocladium*. The family *Cordycipitaceae* was now being examined by a group convened by *Ryan Kepler*. In that case there was a problem in that if *Beauveria* were accepted that would render *Cordyceps* polyphyletic; a consensus still had to be reached on that point.

Leotiomycetes

Seifert introduced the work on this class in the absence of its convenor, *Peter Johnson*, and drew attention to the recently published report (Johnston *et al.* 2014). Of especial concern had been *Botrytis* vs. *Botryotinia*, but the International *Botrytis* Symposium which had met in June 2013 favoured the former name. Other issues that were a matter of debate were: *Monilinia* vs. *Monilia*, *Oculimacula* vs. *Helgardia*, *Phialocephala* vs. *Phaeomollisia*, and *Scytidium* vs. *Xylogone*. They had listed all cases where there were competing names and made recommendations, many of which were not controversial. There was, however, some preference given to sexually typified generic names because of their usage by amateur mycologists. *Demoulin* indicated that he would have liked *Monilia* to remain, but *Seifert* pointed out that *Monilinia* was now extensively used in plant quarantine legislation.

Medical fungi

Weiland Meyer explained that a working group had been established under the International Society for Human and Animal Mycology (ISHAM) and they were considering implications for all medically important fungi. There was a feeling that change was not something to be afraid of, but that changes should not be made arbitrarily. A working group on *Pseudallescheria*/*Scedosporium* infections had favoured the latter and made the necessary new combinations (Lackner *et al.* 2014).

Yeasts

Teun Boekhoet explained that the Committee on Yeast Systematics and Nomenclature of the IUMS International Committee on Yeasts (ICY) had recently prepared a report (Daniel *et al.* 2014). The main problem was with *Candida*, as the pathogenic *C. albicans* belonged to a different clade from the type species of the genus, *C. tropicalis*. In the case of basidiomycetous yeasts, which the Committee had been considering more recently, there was an issue of *Filobasidiella* vs. *Cryptococcus*, and *Filobasidium* proved to be polyphyletic. These issues were to be discussed further at a meeting the Committee was convening at CBS in Utrecht on 18–19 April 2015.

Xylariales

Marc Stadler explained that they had not had a formal working group on *Xylariaceae*, but had received information from many mycologists, leading to a position paper on that family (Stadler *et al.* 2013). No critical decisions in the family needed to be taken, but in the order as a whole there were some competing names that would require a decision after more discussion: *Arthinium* vs. *Apiospora*, *Hypocreodendrom* vs. *Discoxylaria*, *Monographella* vs. *Microdochium*, *Pestalotiopsis* vs. *Pestalosphaeria*, *Seiridium* vs. *Eutypa*, and *Virgaria* vs. *Ascovirgaria*.

Generic names (all fungi)

Kirk *et al.* (2013) had published a list of 6,995 generic names for possible protection across all groups of fungi introduced up to 1 January 2000, out of the 17,072 validly published generic names available. This had received input from numerous mycologists, and took into account the names favoured by all the various working groups, and fungi for which there were no such working groups. For example, the list includes all *Basidiomycota*, *Myxomycota*, *Oomycota*, and lichen-forming fungi. As a consequence of inputs received since publication of the first “without-prejudice” list, and discussions held at various international meetings, names published up to the end of 2012 had been added and a revised version placed on the initiative’s website (www.generaoffungi.org) prior to the Congress. Places of publication and type species are listed on the website, but were omitted from the printed list because of space constraints. The compilers were concerned that without such a list many generic names in use would remain unprotected until after the 2023 International Botanical Congress.

Time did not permit this list to be discussed during the Sessions, but corrections and comments from all mycologist are welcomed so that they can be incorporated in a revised list in due course.

OTHER MATTERS

A few comments made on the Questionnaires did not directly relate to the questions, but are drawn to the attention of the wider mycological community here.

Several respondents expressed concern over the apparently exponential growth in species names and an over-reliance on molecular phylogenetic methods. One considered that it was not practical to have isolates of *Colletotrichum gloeosporioides* from the same host, identical ITS sequences, and spore morphology split into six separately named species.

Another was concerned that phylogenetic studies at the generic level often revealed that some species described in them fell outside the revised concept, but acknowledged that nomenclatural changes could not be stopped.

A fourth was concerned at the variety of sequences being used for taxon delimitation, but felt if many were used that would be of great benefit; mycologists in less developed countries could help in containing the costs of this if funds to support them were available.

One commentator indicated that he would like mycologists to get back to classification as currently only cladification was being used.

In view of the changing names of fungi, yet another person wished authors to cite the currently accepted name for a species at first usage, but subsequently to refer to it by its familiar name in subsequent discussion, for example *Ophiocordyceps sinensis* and *Cordyceps sinensis*. He felt this dual usage should also be encouraged in lists of key words, and encouraged (or enforced) as a matter of editorial policy for any journal dealing with fungal names. As the newer names became more generally accepted, the historically used names could be dropped.

RESOLUTIONS

IMC10 had been charged by the ICN with ratifying the decisions of the NCF on the appointment of repositories of nomenclatural information on fungi (see above). After some discussion, and taking note of a preliminary analysis of responses to the Questionnaire, the following text was approved by 63 delegates then present in the Session, with some abstentions, but no one voting against:

Resolution 1: *The Tenth International Mycological Congress, in Bangkok, Thailand, resolves that the decision of its Nomenclature Session with respect to Article 42 of the International Code of Nomenclature for algae, fungi, and plants, made 7 August 2014 regarding official repositories for the registration of fungal names, namely to recognize multiple repositories: Fungal Names, Index Fungorum, and MycoBank, be accepted.*

IMC10 had no mandate to take decisions on other matters relating to nomenclature, but had provided an opportunity for mycologists to express their views on a wide range of topics. The Nomenclature Session wished those views to be considered in formulating proposals for changes

in the rules at the subsequent IBC in 2017. Therefore, the Nomenclature Session, at its last meeting during the Congress, also approved the following Resolution. The decision was unanimous with none of the delegates present voting against:

Resolution 2: *IMC10 notes the views expressed in the responses of delegates to the questionnaire given to all registrants at this Congress with respect to future directions for the nomenclature of fungi, and ask that they be taken into account in formulating changes in the rules for consideration at the International Botanical Congress in 2017.*

These two Resolutions were presented by *Redhead* to the new president of the International Mycological Association (Keith Seifert), who then presented them to the Closing Plenary Session of the Congress (incorporating the General Assembly of the International Mycological Association) on 8 August 2014, where they were adopted unopposed.

The views expressed in the IMC10 Nomenclature Sessions, as recorded here, and in responses to the Questionnaire, will be taken into account in the drafting and development of formal proposals for consideration by the IBC in 2017.

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